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## ARON'S ELECTRIC METER.

AN electric current meter which is attracting much attention in this country, where it has been introduced but recently, is shown in the accompanying illustrations. It is the invention of Professor H. Aron of Berlin, who claims for it that it surpasses all similar devices in point of reliability. It received a gold medal at the Melbourne Exhibition, and has been adopted, in preference to other meters, by the Siemens & Halske and Edison electric lighting companies of Berlin, and by the Berlin municipal electric lighting works. It is also used in Paris, Vienna, Constantinople, and other cities, where it has proved itself valuable for central station work.

The Aron electric meter is made to measure both direct and alternating currents, and from three-wire to nine-wire systems, from fifteen to twelve hundred ampères, and from a hundred up to any

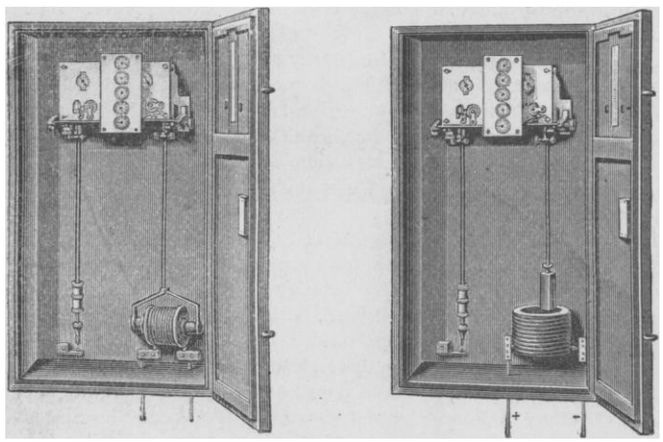

FIG. 1 AND 2.—ARON ELECTRIC METER.

desired number of volts. The action of the meter is based upon magnetic attraction. The mechanism consists of two sets of clock-work of ordinary construction, the pendulums of which swing synchronously while no current is passing through the meter. The left-hand pendulum is of the usual construction. The other varies according to the current to be measured. The measuring pendulum shown in Fig. 1, which is an alternating-current meter, carries a fork-shaped piece of brass fitted with a coil of fine wire, which swings freely through the interior of a fixed coil of large wire. The main current passes through the outer coil, the interior coil being in a shunt-circuit. The mutual action of the two coils upon each other effects a variation in the time of oscillation of the right-hand pendulum proportional to the product of the electric tension and the quantity of the current; hence the measuring pendulum swings faster the greater the tension and quantity of current passing through the meter. While the pendulums swing in unison, the dial train is idle, but when the current is passing, the dial-train registers the difference in the pendulum oscillations, the latter being greater or less according to the tension and quantity of the current.

In the direct-current meter, the right-hand pendulum carries as a weight a permanent steel magnet, which swings over a coil of copper wire, through which the current passes. As in the other meter, the pendulums swing in unison until the current begins to pass through the coil, when the measuring pendulum swings faster, its rate of swing being governed by the amount of current.

The measuring-pendulum of the meter for the three-wire system carries two permanent magnets attached to a cross-piece of brass,

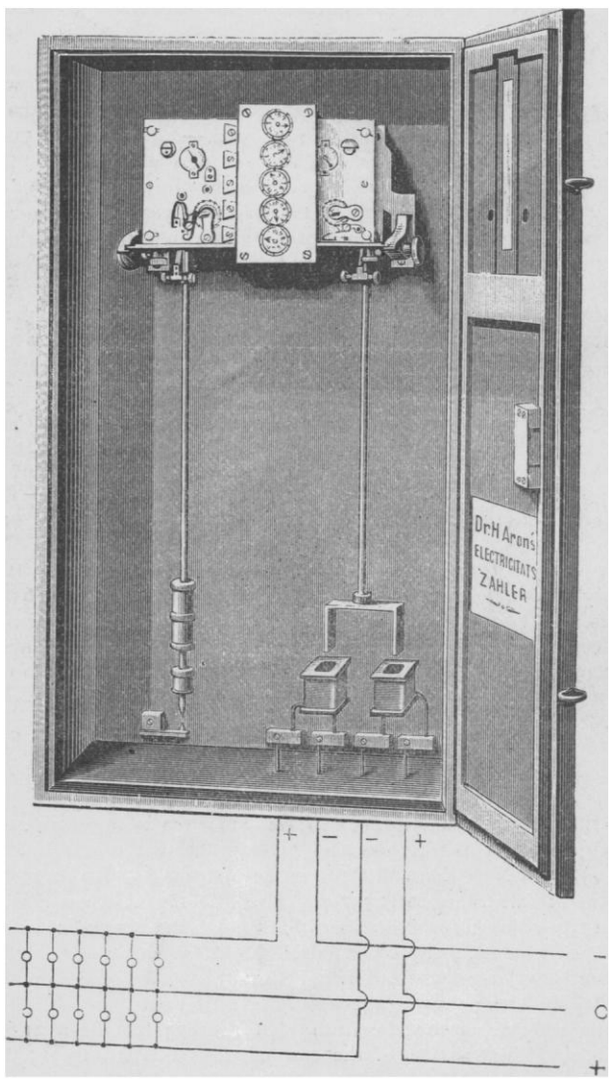


FIG. 3.—ARON ELECTRIC METER.

(For three-wire system.)

each magnet swinging immediately above a coil of wire through which the current passes, the main wires being connected to the coils as shown in the diagram at the bottom of Fig. 3. The meters for five, seven, and nine-wire systems differ only in the fact that they are provided with a greater number of permanent magnets on the pendulum and a corresponding number of coils.

## RAILROADS IN THE UNITED STATES IN 1889.

THE year 1888 is notable for the reason that it marks the beginning of the second century of our existence as a nation. When Washington was inaugurated one hundred years ago, our population was less than 4,000,000: to-day it is estimated at 65,000,000. Enormous as has been this increase in the population of the country within the short period of one hundred years, the increase in wealth and material prosperity resulting from the rapid development of the country's wonderful resources has been in even greater ratio; has, in fact, no parallel in the history of the world.

That these wonderful results are due chiefly to the rapid expansion of our railroad system, none will gainsay. What our condition would be without railroads, it is impossible to conceive: what it is, having them, is universally known.

Of the total railroad mileage of the world, the United States now possess nearly one-half. At the end of 1888 the aggregate length of all lines in the country, according to "Poor's Manual for 1889," to advance sheets of which we are indebted for our facts, was 156,082 miles, all built in sixty years, the average mileage constructed per year being nearly 2,600 miles; but this record of sixty years, wonderful as it is, fades into insignificance when compared with the achievements of the past twenty-three years, — since the close of the civil war.

The total mileage of our railroads at the close of 1865 was 35,085 miles. In the twenty-three years since then, there have been constructed 121,000 miles of new road, — an average of 5,260 miles per annum, twice the annual average of the whole period of sixty years, and 5.3 times the annual average of the first period of thirty-five years. During these twenty-three years the country has experienced three great waves of railroad construction, which were checked only by extraordinary financial revulsions.

The first of these great construction waves occurred within the eight years intervening between the close of the war and the panic of 1873. In that time the mileage increased more than 100 per cent, or from 35,085 miles in 1865, to 70,268 miles in 1873. Within this period was completed the first Pacific Railroad line, and construction on a second line to the Pacific was well under way. The cash cost of the 35,000 miles of road constructed in these eight years must have exceeded $1,400,000,000; and the panic, which began in the fall of 1873, was largely the result of the transformation — following so close in the wake of a great civil war — of this vast sum from floating into fixed capital.

In New England, during this period, railroad mileage increased nearly 2,500 miles; in the Middle States the increase was 6,070 miles, about 75 per cent; in the South it increased 4,000 miles, 44 per cent; and in the Pacific States the increase was from 166 miles to 2,193 miles. But the great increase of this period was in the Western and South-western States.

At the close of 1873 the total capital investment in all the railroads of the United States was $3,784,543,034, represented by share capital to the amount of $1,947,638,584, and bonded debts to the amount of $1,836,904,450. This vast aggregate represented also the cost of 70,651 miles of railroad then in operation, the average cost per mile for the whole country at that time equalling $60,057. In New England the average cost was $47,850 per mile; in the Middle States, $67,737 per mile; in the Western States, $52,125 per mile; in the Southern States, $36,994 per mile; and in the Pacific States, $95,590 per mile. The maximum cost per mile was in New Jersey, where it averaged $115,829; the minimum was in Florida, where the average was only $18,445 per mile.

The increase of mileage from 1871 to 1873 had been 21,623 miles, and the increase of the cost of the roads $1,119,915,389, nominally. One cause for the excessive mileage built within a few years was the extraordinary effort to complete roads, in order to save from lapsing the vast grants of land made by Congress, on condition that the roads should be built within a certain time. But the increase was far beyond the possibility of speedy returns for the capital invested. That much land could be found unoccupied near the line of a railroad implied a sparse population; and, although prairie soil could quickly be brought into cultivation, it would be long before there could be sufficient traffic to pay the interest on the cost of the roads. Excessive competition and speculation in railroad building and railroad bonds and stocks ensued, until, in September, 1873, the great financial storm which has since passed into history as the "panic of 1873" burst upon the country.

The depression which followed extended through the years 1874–78. During 1879 matters began to improve throughout the country, and this feeling soon became reflected through the railroads. In that year construction increased nearly 100 per cent over the preceding year.

During these fifteen years there were built 85,814 miles of new railroad, an increase of over 122 per cent; that is, in the last fifteen years we built 15,546 miles of railroad more than we built in the preceding forty-five years. The first five of these fifteen comprised a period of depression; the next four years were years of unexampled activity; while the three years of 1883, 1884, and 1885 were years of hesitancy, in which no new railroad enterprise of great magnitude was begun, as was natural, after the completion in a single year (1882) of 11,600 miles of road. In 1886 there were built 8,128 miles, and in 1887, 12,984 miles, the latter surpassing the record of any previous year; and in 1888, 7,028 miles. In the three years the new construction aggregated 28,140 miles, or within 58 miles of the extraordinary record of the three years 1881–83.

The increase in mileage during the ten years from 1840 to 1850 was 6,202 miles, or 220 per cent. The average mileage constructed per year in this decade equalled 620.3 miles. In the succeeding decade, 1850 to 1860, 21,605 miles were added, an average of 2,160.5 miles per year, the increase equalling nearly 240 per cent. The next ten years, 1860 to 1870, showed an increase of only 73 per cent, or 22,296 miles, the falling-off from previous records being due to the outbreak of the war. Between 1870 and 1880, 45,375 miles were added, an increase of nearly 86 per cent. Since 1880, 57,786 miles have been built.

Since the revival of railroad construction in 1879 there have been completed three additional through transcontinental railroads, — the Northern Pacific, the Atlantic and Pacific, and the Southern Pacific; while the Union Pacific by the construction of its Oregon Short Line north-west to a connection with a branch of the Oregon Railway and Navigation Company's system, the Atchison by the construction of its line to a connection with the Southern Pacific, and the Chicago, Burlington, and Quincy by the construction of its Denver extension, have added three other important routes to the Pacific. At least three of the great Western railroad systems are now stretching westward, with the evident intention of speedily reaching the same ocean.

A striking feature of the last decade of railroad building is the large number of speculative and parallel lines which were put under way, and many of them completed, notably the West Shore Railroad, which parallels the New York Central line for its whole length from New York to Buffalo; the "Nickel-Plate" line, which parallels the Lake Shore in like manner from Buffalo to Chicago; and the South Pennsylvania, paralleling the Pennsylvania Railroad between Philadelphia and Pittsburgh, upon which a vast sum was expended, but which has not been completed. In some instances such lines were perhaps undertaken with a view to forcing their subsequent purchase by the older companies whose lines they sought to parallel; and in the case of the two roads first mentioned these plans met with eminent success. But their fulfilment was in the main the cause of the depression which existed during the years 1885, 1886, and 1887.

The chief feature of railroad construction of the "wave" of 1886–88 has been the extraordinary activity displayed by the older and more powerful corporations of the North-west and South-west in the extension of their lines, with the apparent purpose of securing a firm foothold upon every available foot of territory contiguous to their several systems, or within reach thereof. The result of this policy has proved in many instances unwise, if not disastrous, as an examination of the facts herein set forth will show.

The most important lines which have been constructed during that period are here briefly summarized: North and north-west of Chicago there have been completed the Duluth, South Shore, and Atlantic Railway, forming a new short route between Duluth and

Sault Ste. Marie, where connection is made with the Canadian Pacific Railroad, under whose control the Duluth line has passed. The Minneapolis, St. Paul, and Sault Ste. Marie has completed an equally important line between Minneapolis and St. Paul and the "Soo," and has also constructed an extension north-west of Minneapolis to within a short distance of Bismarck, Dak. Between Chicago and St. Paul two important new routes have been opened, — the Chicago, Burlington, and Northern, and the Chicago, St. Paul, and Kansas City. The latter company also extended its line south-west to Kansas City, to which point the most important extension of the Chicago, Milwaukee, and St. Paul Railroad within the three years was built. Running far west to Helena and Butte, Mont., the St. Paul, Minneapolis, and Manitoba Railway Company completed a line which is the most northerly east-and-west line of importance in the United States.

The total number of miles of railroad in the United States at the close of 1888 was 156,082, of which 7,028 miles were constructed during the year, the rate of increase being 4.7 per cent. The mileage of lines making returns of their share capital and funded and floating debts equalled 154,276, against 147,999 for 1887, the increase being 6,277, the rate of increase being 4.24 per cent.

The share capital of the mileage completed at the end of 1888 equalled $4,438,411,342, against $4,191,562,029 in 1887, the increase equalling $246,849,313, the rate of increase being about 5.9 per cent.

The funded debts of all the lines at the close of the year aggregated $4,624,035,023, a sum $437,091,907 in excess of the total of 1887 ($4,186,943,116), an increase of nearly 9.5 per cent. The other forms of indebtedness of the several companies at the close of the year equalled $306,952,589, against $294,682,071 for 1887, the increase being $12,270,518. The total share capital and indebtedness of all kinds of all the roads making returns equalled at the close of the year $9,369,398,954, an increase in the year of $696,211,738 over the total of 1887 ($8,673,187,216) the rate of increase for the year being about 8 per cent. The cost per mile of all the roads making return as measured by the amount of their stocks and indebtedness equalled very nearly $60,732, against $58,603 for 1887.

The gross earnings or receipts of all the lines (including elevated railroad) from which returns were received for the year equalled $960,256,270, of which $251,356,167 were received from transportation of passengers; $639,200,723 from transportation of freight; and $69,699,380 from the transportation of mails and express matter, profits of leased lines, and other miscellaneous sources of revenue. In the latter sum are included the gross earnings of elevated railroads. The gross earnings of all the lines for the year ending Dec. 31, 1887, equalled $940,150,702; the increase for the year 1888 equalling $20,105,568, or 2.14 per cent. The earnings in 1887 from transportation of passengers equalled $240,542,876; from freight, $636,666,223; from transportation of mails and express matter, etc., $62,941,603, against $69,699,380 for 1888. The earnings per mile from which full returns were received in 1888 equalled $6,540, against $6,861 for 1887, the decrease equalling $321 per mile. The net earnings of all the lines for 1888 equalled $301,631,051, against $334,989,119 for 1887, the falling-off equalling $33,358,068, the rate of decrease being about 10 per cent.

The amount of interest paid in 1888 equalled $207,124,288, against $203,790,352 in 1887, the increase being $3,333,936, the rate of increase equalling more than 1.63 per cent. The amount paid in dividends in 1888 equalled $80,243,041, against $91,573,458 in 1887, the falling-off equalling $11,330,417, the rate of decrease being about 12.4 per cent.

The number of persons transported in 1888 by all the lines was 451,353,655, against 428,225,513 for 1887, the increase for the year being 23,128,142, the rate of increase equalling 5.4 per cent. The number of passengers carried one mile in 1888 equalled 11,190,613,679, against 10,570,306,710 for 1887, the increase equalling 620,306,969 persons carried one mile, the rate of increase equalling very nearly 6 per cent. The distance travelled by each passenger in 1888 equalled 24.78 miles; in 1887, 24.68 miles. The amount received per passenger per mile equalled 2.246 cents in 1888, against 2.276 cents in 1887. Had the passenger rates for 1887 been maintained for 1888, the earnings from this source would have equalled $255,034,086, a sum $14,491,210 greater than that received.

The number of tons of freight transported on our railroads in 1888 equalled 589,398,317, against 552,074,752 tons in 1887, the increase equalling 37,323,565 tons, the rate of increase being about 6¾ per cent. The value of the tonnage moved in 1888, estimating its value at $25 the ton, equalled $14,633,957,925. The number of tons transported one mile in 1888 equalled 70,423,005,988, against 61,561,069,996 tons moved one mile in 1887, the increase of service performed for the year equalling 8,861,635,992 tons moved one mile, the rate of increase being about 14.4 per cent.

When "Poor's Manual for 1888" was published, it recorded the greatest amounts, in the aggregate, ever earned, either gross or net, by the railroads of the country. In the midsummer of 1888 the situation presented many hopeful aspects, and it was widely believed that the period or depression had passed. The volume of business throughout the country was larger than ever in its history, and an improvement in earnings was therefore confidently looked for. But unfortunately, while the traffic was large and of increasing proportions, the rates received for its transportation, owing to the fierce and unbridled competition in the West, drooped continually.

It appears that in the seven years 1882–88 the tonnage increased 228,907,942 tons, or 63 per cent. In the same period the mileage of lines in operation increased 49,588.91 miles, or 51 per cent. Computed on the basis of tonnage per mile of road, the traffic of 1882 was 3,650.5 tons per mile; of 1883, 3,744.7 tons per mile; of 1884, 3,526.2 tons per mile; of 1885, 3,578.6 tons per mile; of 1886, 3,853.4 tons per mile; of 1887, 4,030.1 tons per mile; and of 1888, 4,055.2 tons per mile. It thus becomes apparent that the traffic of the past two years was the largest ever carried by the railroads of the country. During 1888 the volume of freight traffic was exceptionally large; and, with an increase of eight miles in the average length of haul per ton, the earnings from this source should have been, had fairly remunerative rates prevailed, sufficient to insure a continuance of dividends by the great trunk lines rather than their suspension, as has been the case in so many instances.

The tonnage-mileage of 1887 was 61,561,069,996, for transporting which the railroads received an average rate of 1.034 cents per ton per mile, producing a revenue of $636,666,223. In 1888 the tonnage-mileage was 70,423,005,988, which produced an average revenue per ton per mile of .907 of a cent, or, in the aggregate, $639,200,723. Had the rates received in 1887 prevailed in 1888, the difference of about 1¼ mills per ton per mile would have given the railroads an increased revenue of $89,189,819, sufficient to pay more than 2 per cent upon the total amount of capital stock outstanding at the end of 1888, upon all of the roads contributing toward this grand aggregate.

The causes which led to this unlooked-for result are now thoroughly understood. The sentiment is unanimously expressed that the chief elements of disturbance in the railroad situation in the West have been, first, the unprecedented activity with which the railroad systems of that section have been extended, as a result of the desire to secure entrance to the newly developed lands in the West and South-west; second, the partial failure of the crops, and the consequent loss of a large proportion of the traffic which had been calculated upon; third, the complications resulting from the application of a new and radical law, — the Interstate Commerce Act; and, fourth, the spirit of hostility and repression evinced by the legislatures of some of the Western States.

To these several causes, which were in themselves sufficient to demoralize the business of even so powerful a system as that of the railroads, might be added a fifth and perhaps most potent cause of all; that is, the very mightiness of the contestants and the magnitude of the interests involved. In no period of the world's history has there been such vast aggregations of capital engaged in commercial enterprises as are now to be found in this country. Nor is there any country in which competition in business is freer and sharper than in ours. In this general competition the railroads of the country have taken active part. The construction of new lines has been encouraged in every part of this country, in no section more strongly than in those which are now displaying the most

violent antagonism toward them. Nowhere were greater inducements held out to capital to supply railroad facilities than west of the Mississippi, between the close of the war and the early seventies; yet in those very States, which owe their present prosperity and development to no cause more than to railroads, we see the most rampant hostility displayed toward the creators of their wealth.

In the early days of railroads in this country, their profits reached very respectable proportions. In some instances, where the lines were especially favored in respect to location and physical surroundings, these returns were so large as to excite the cupidity of capital to such an extent that, at several periods of the country's history, the eagerness displayed by railroad constructors in pushing their lines beyond the requirements of the territory resulted in plunging the country into financial crises having far-reaching effects. But the days of large profits appear to have passed. A railroad which in the future can pay regular dividends of 5 per cent per annum, will be regarded in much the same light as those which formerly paid 8 and 10 per cent for years without intermission.

In the Manual are three tables, showing the decline in freight rates upon various railroads of the United States. Table No. 1 includes seven leading Eastern trunk lines, running between Chicago and the seaboard, and covers the twenty-four years, 1865 to 1888 inclusive. Upon these roads the rates received for transportation of freight declined from 2.9 cents per ton per mile in 1865, to .609 of a cent per ton per mile, — a reduction of 79 per cent within the period covered by the statement: in other words, the railroads comprised in that statement received, in 1888, $21 for the performance of a service for which in 1865 they received $100. What other business can show a corresponding decrease in returns?

Table No. 2 gives like statistics for six leading Western trunk lines running west, north-west, and south-west of Chicago, and embracing the same period, 1865 to 1888. Upon these lines the reduction equalled 73 per cent in the twenty-four years, or from 3.642 cents per ton per mile in 1865 to .934 cent in 1888.

The thirteen roads embraced in these two tables are typical of the entire railroad system. Upon the basis of the deductions here shown, it may be assumed that the average reduction throughout the whole country since the close of the civil war has been at least 70 per cent. To earn an amount equal, on the average, to that earned twenty-four years ago, the railroads are now required to perform a service nearly three times as great. Yet, notwithstanding this, the cost of operating the lines has not been decreased to any appreciable extent. Of the total cost of operating a railroad, fully 80 per cent is paid to labor in one way or another. Expenses of this nature cannot be materially reduced: in point of fact, the tendency is constantly toward an increase. The average rate of wages paid by railroads is to-day as large as in 1865, if not larger. It becomes plain, therefore, that the immense sums that have been annually lost to the railroads of the country by their voluntary reductions in rates have been a corresponding saving to the public at large. A calculation of the sums saved to the public by these reductions in rates during the past quarter-century would reach far up into the thousands of millions.

During all these years the railroads have met with most active competition from the waterways of the country, upon which freight can always be transported at about one-third of the cost of railroad transportation. It early became apparent to the railroad companies that to make their lines pay required an immense volume of traffic, which could only be secured by the development of their routes to a point where competition from waterways need not be feared. With this view, tracks have been doubled, trebled, and even in some cases quadrupled; roads have been almost entirely rebuilt with heavy steel rails; locomotives and cars of double or treble their former capacity have been constructed; and trains have been run with a frequency and at a rate of speed which were once considered to be among the impossibilities.

The effect of all this is seen in the wonderful development of all sections of the country, but particularly in the Western States, in which the progress recorded in a short quarter of a century is justly regarded as one of the marvels of the present age.

In proportion to population, the earnings of the railroads in the States of Ohio, Michigan, Indiana, Illinois, Wisconsin, Minnesota, Dakota, Iowa, Nebraska, Missouri, and Kansas were considerably higher in 1888 than in 1870, being $18 per capita in the former year as against $12 in the latter, the increase being 50 per cent. But this increase of averages is a very deceptive one, as, calculated upon the basis of mileage, — the only true test, — the earnings in 1888 were but $5,728 per mile, as against $6,753 per mile in 1870. The falling-off of revenues in these States equalled more than $1,000 per mile, which for 1888 alone amounted to an aggregate of $73,000,000.

With these facts before us, it is difficult to understand the extraordinary antipathy to railroad corporations now prevalent in the West. The railroad mileage of the West has advanced in far greater ratio than the population, and the wealth and commerce of that section have kept pace with the railroad mileage. Were the railroads to be advanced only in ratio to the increase in population, the situation in the West and throughout the country would present an entirely different aspect, and public sentiment would experience a corresponding change.

The acreage of wheat and corn in Ohio, Michigan, Indiana, Illinois, Wisconsin, Minnesota, Dakota, Iowa, Nebraska, Missouri, and Kansas in 1888 was 66,435,304 acres. No figures of acreage in 1870 are obtainable, but it was undoubtedly less than 30,000,000 acres in that year. Without railroads, the products of this immense territory would be to a large extent valueless; but such trifling matters as these are always dismissed from the consideration of demagogues when they strive to excite the public mind upon the rapacity and greed of railroad corporations.

In point of importance, the railroad interest now takes precedence of all other industries or enterprises. Its magnitude is greater than any other interest in the world, and it has become so thoroughly a part of the economic system of the Republic as to be second only to the government itself.

In order to show how closely interwoven are the interests of railroad stockholders and the working-classes of the country, a few calculations are herewith submitted.

If we estimate that in the operation of our railways there are employed in prosperous times an average of six persons per mile of road, it would show a total, on the basis of our present mileage, of more than 936,000 persons regularly employed in connection with that single interest; and if to this number we add 780,000 — a number representing an average of five to the mile — as the number of persons employed in connection with all those industries which are directly affiliated with and dependent on our railway system, such as locomotive and car building establishments, rail-mills, etc., we have a total of nearly 1,716,000, or an average of 11 to the mile of railroad. Assuming that each of these would represent a family averaging five persons, we have an aggregate population of 8,580,000, — nearly one-seventh of the total for the country at large, — of which 90 per cent are actually dependent on the railway system for the sustenance of life. If we allow, as the average rate of wages of those employed in operating, say $450 per annum, and for those employed in locomotive building, etc., say $500 per annum, we have a total pay-roll of $911,200,000 per annum, of which at least $500,000,000 is directly chargeable to operating account, while the remainder is for account of betterments, improvements, and new construction. Add to this the amount paid to laborers engaged in construction in such a year as 1887. In that year there were built new roads whose aggregate length was 12,984 miles. If we take, as the average cost of labor in grading, track-laying, etc., for each mile of this total, say $10,000, and allow the average daily wages of laborers to be $1.50, with, say, 100 laborers of all classes to each mile, this would show the average time for the completion of a mile of railroad to be 67 days. On this basis, the construction of 12,984 miles of railroad would give steady employment for 300 days in the year to an army of 289,976 laborers, whose total earnings would be $129,840,000.

This gives a total of 2,006,000 persons, to which we will add 44,000 as the number whose labors are stimulated by the employment of the 289,976 last mentioned, making a total of 2,050,000, representing families numbering in the aggregate 12,250,000 persons. To maintain this number, there would be expended by railroads and others under the above calculations at least $1,040,000,000

per annum, or very nearly $3,000,000 for each day in the year. The regular expenditure of more than 90 per cent of this vast sum stimulates other industries, and in this manner the volume of general business is increased in progressive ratio.

In these calculations no account has been taken of the large number of people forming the proprietary interest of this vast aggregation of capital, which comprises people in all classes and in all occupations, and scattered throughout all parts of the country.

The New York Central Railroad Company has 10,000 stockholders, whose average holding is about $9,000. If we take that sum as representing the average holding of all stock and bondholders in the country, the total number of such would be over 1,000,000, representing more than 5,000,000 persons with important interests in the success of the railroad system.

From these deductions a general idea can be gathered of the magnitude of the railroad interest, and how vast and widespread is the interest of our people in that system.

From the tables in the Manual it appears that during the past ten years the following percentages of profit have been distributed to holders of the share capital of our railroads. In 1879 the dividends paid averaged 2.5 per cent of the total amount of capital stock outstanding; in 1880, 2.8 per cent was paid; in 1881, 2.9 per cent; in 1882, 2.91 per cent; in 1883, 2.75 per cent; in 1884, 2.48 per cent; in 1885, 2.02 per cent; in 1886, 2.04 per cent; in 1887, 2.18 per cent; and in 1888, 1.77 per cent.

## BUHACH.

IN an article on the California insecticide known as buhach, which was mentioned in *Science* of May 24, the *Journal of the Society of Arts*, London, says this product is a fine powder made from the flowers of the *Pyrethrum cinerariæfolium*, largely used for the destruction of insects. This plant was originally a native of Persia, from whence it was introduced to Dalmatia and adjoining States of Herzegovina and Montenegro, where it has been almost exclusively cultivated until a few years ago. The importance of this industry was considered so great in these countries that special efforts were made to prevent the export of seeds and plants by the governments. The plant was first introduced into California about twelve years ago by a Mr. Mileo, a native of Dalmatia, who succeeded, after some trouble, in obtaining seed from his country. After experimenting for some time, in order to find a suitable soil and climate, this gentleman finally succeeded in growing the plant on an extensive scale, and in 1880, associating himself with other capitalists, established the Buhach Producing and Manufacturing Company. At the present time the company have about 300 acres of this plant under cultivation at their farm near Atwater, Cal., and own mills for grinding the dried flowers to powder at Stockton. The cultivation of pyrethrum requires careful and intelligent supervision, and it cannot be grown successfully without irrigation. It requires three years from the time of sowing to grow plants capable of producing a paying crop of flowers, and then they will bear from four to five years longer. It is at its prime, however, in its fourth or fifth year. The plant grows about thirty inches high, and is set out in rows four feet apart, and from fifteen to twenty-four inches apart in the rows. The flowers are harvested towards the latter part of May. The stalks are cut just above the roots, and the flowers stripped from them by passing the plants through a kind of comb. The detached flowers fall into a box below, and are carried to the drying ground, where they are spread on sheets and exposed to the rays of the sun during the day, being repeatedly turned over in the meantime. They are covered during the night to prevent their absorbing moisture, as the perfect drying of the flowers is most important in order to retain the volatile oil which gives the powder its insecticide properties. It is also very necessary that this operation should be done quickly, and that the flowers during the drying process should be protected from moisture. A slight dew falling upon the flowers at this time will injure their color, and reduce their strength as an insect destroyer. In this respect the California-grown flowers are better cured, and, consequently, more valuable than those produced in Dalmatia, it being acknowledged by experts that the particular conditions of soil and climate in California are extremely favorable to the growth and curing of plants rich in the essential oil which renders them so destructive to insect life. Like many other products, insect powders are liable to adulteration, and last year a large quantity made from the flowers of the Hungarian daisy, mixed with a small proportion of pyrethrum, was placed upon the market by unscrupulous dealers. Inferior powders are also manufactured from the stems and leaves of the plant, which possess, to a certain extent, the properties of buhach.

## SAWING STONE BY HELICOIDAL WIRE CORD.

A NEW plan of cutting stone by means of wire cord has been adopted in many European quarries. While retaining sand as the cutting agent, M. Panlin Gay, of Marseilles, has succeeded in applying it by mechanical means, and as continuously as the sand blast and band-saw, with both of which appliances his system — that of the "helicoidal wire cord" — has considerable analogy.

An engine puts in motion a continuous wire cord (varying from five to seven thirty-seconds of an inch in diameter, according to the work), composed of three mild steel wires twisted at a certain pitch, that found to give the best results in practice, at a speed of from fifteen to seventeen feet per second, the higher speed being adopted for the smaller diameter.

Instead of the stone being brought to the saw, the wire cord, which may be of indefinite length, is led to the stone, being guided by grooved pulleys, mounted on bearings with universal joint, which permits of their adapting themselves to any change of direction. The same cord, which is kept at uniform tension by a weighted truck on an inclined plane, may act upon any number of blocks, provided sufficient space be given between them to allow for cooling.

The pulleys are mounted in standards, and are fed down by endless screws rotated automatically if the stone be uniform, but preferably by hand if there is reason to suspect irregularities in its texture. Sand and water is allowed to flow freely into the cuts, the sand carried along by the cord in the spiral interstices between the wires causing a uniform attrition of the stone. The twist of the cord causes it, while travelling, to turn upon itself, and thus become worn evenly. A cord of 150 yards in length will cut about seventy feet deep in blocks fifteen feet long, or produce four hundred and ninety square feet of sawn surface before being worn out.

The sand must be sharp, and not used more than three times. The nature of the sand is determined by the hardness of the stone; thus, quartz sand will cut granite and porphyry, which it has hitherto been found impossible to saw, or indeed cut in any other way than by pick or chisel. An hourly advance of one inch in granite or porphyry and four inches in marble, is regularly obtained in blocks of fifteen or sixteen feet long. At the Brussels Exhibition of last year, where the system was awarded a prize, the same cord which cut marble also cut a block of concrete composed of quartz pebbles.

Not merely does the helicoidal cord saw blocks of stone, but it even cuts them out of the solid rock in the quarry. To do this, it is necessary to sink shafts of two or two and a half feet in diameter, in order to introduce the pulley-carriers. If there is a free side to start from one shaft is sufficient for a triangular block; but for a quadrangular one, which is preferable, two shafts are necessary. They are bored by a mechanical perforator, consisting of a hollow plate-iron cylinder, having at its lower end a slightly thicker collar which acts with sand and water in its latest development. The cylinder is made to revolve, at a speed of one hundred and forty revolutions a minute, by means of a tele-dynamic cable, advancing about an inch per hour in marble. An annular space is cut in the rock, leaving a core, which may be utilized as a column. The diameter of the shaftway depends upon the diameter of columns most in demand, provided a sufficient number be sunk, and the intervening angles broken down, so as to afford sufficient room for the pulley carrier.

In the case of stratified rocks, the shaft-cuts are carried down to a natural parting; but in unstratified rocks a nearly horizontal cut may be made with the cord, sufficient inclination being given to insure the flow of sand and water to the bottom of the cut.

Such is the method of working practised at the Traigneaux

Quarry, near Philippeville, in Belgium, where fifteen thousand cubic feet of marble are extracted yearly with a thirty horse-power engine, and only thirty hands in summer and twenty in winter, besides the lads who tend the wire-cords. The system is also employed at granite and marble quarries in France, Germany, Spain, Italy, Algeria, Tunis, and other countries, where it is said to be giving satisfactory and economical results.

## SEWAGE PURIFICATION.

A NEW process for the purification of sewage, under patents granted to the firm of Jagger, Son, & Turley, of Halifax, England, was recently experimented with at the corporation sewage works of that city. The apparatus employed is described as follows. A carbon filtering medium is obtained by reducing to a carbonized state dry ashpit refuse which contains a large proportion of animal and vegetable matter. The refuse is placed in a carbonizer, where it is allowed to remain until the whole mass is charred by a process of slow combustion. After the carbonized material is withdrawn from the carbonizer, it is sifted by means of a circular riddle; and the cinders and a small percentage of clinkers are laid on one side for use in forming the bottom layers of the filters. The finer grades given out by the riddle, composed principally of charcoal and a small percentage of ashes, are placed as an upper layer of a shallow filter bed, about four inches in thickness.

A small carbonizer has been erected at Halifax, and a filter of 102 superficial yards laid down. The filter is two and a half feet deep, it has a six-inch concrete bottom, and brickwork sides joined in cement. The filter is divided by a fourteen-inch wall, underneath which is laid a channel for conveying away the effluent. The bottom course of brickwork of the central wall is open jointed to allow the effluent to pass from the layers of cinders to the channel. The filter bed is formed as follows. At the bottom is placed a six-inch layer of rough material, which may be clinker or broken bricks or stone. Above this layer is placed another composed of one-inch cinders laid three inches thick; then follows a layer three inches thick of quarter-inch cinders, and finally a layer of carbon four inches thick, giving a total thickness of sixteen inches. The filter is worked with a six-inch head of sewage. The sewage is conducted to the filter by a six-inch pipe, having branches, the pipe being laid on the top of the central wall. Under each branch is placed a floating splash-board, which prevents the sewage washing a hole through the filtering material. The sewage flows over and through the carbon. The effluent is clear, inodorous, and colorless, and has been proved by analysis to be very pure. The organic matter in suspension was 417.2 grains per gallon in sewage, and 1.12 grains per gallon in effluent. The albumenoid ammonia in solution was also reduced from 0.280 grains per gallon in sewage to 0.007 grains per gallon effluent.

The manner of dealing with the sewage is as follows. Across the outfall sewer are placed a series of wire-work baskets filled with cinders of different grades, to arrest the grosser floating solids. The sewage then flows to the filter-bed, where the purification of the sewage is accomplished. No chemicals whatever are used. The filter-beds will work at a rate of from 240 to 300 gallons per superficial yard per day, according to the density of sewage treated. An acre of filtering surface will be ample for dealing with the sewage from 30,000 persons, or say, 1,000,000 gallons per day. The land required for this process is only one two-hundredth part of that required for broad irrigation, or one-fortieth that required for combined precipitation and filtration. The capital cost for this process will be about $340 per thousand inhabitants up to a population of fifty thousand, and the annual working expenses for collecting and disposing of refuse and purifying sewage, inclusive of interest on capital and royalty fees, about sixteen cents per head of population.

This process solves the sludge difficulty. No chemicals being used, no weight is added to the solids in the sewage; the grosser solids are arrested in the cinder baskets, and the finer solids are deposited on the top of the filters in the form of a thin skin After a filter has worked for twenty-four hours, the flow into that particular filter is stopped, the moisture allowed to drain off, and the deposit removed by a scum plow, a little fresh carbon is laid, and the filter is then again ready for work. By a simple mechanical contrivance, a filter of one hundred yards can be cleansed and re-charged in ten minutes. The average weight of sludge made per million gallons of sewage treated by chemicals is twenty tons. In place of a semi-fluid, offensive sludge, by this carbonized refuse process, there remains a manure uninjured by chemicals, which can be carted away as it is removed from the filters, and which will equal in bulk seven and a half tons per million gallons treated.

## HEALTH MATTERS.

### Leprosy.

AT a recent meeting of the Epidemiological Society of London a paper was read by Dr. P. S. Abraham, on leprosy, of which the *Lancet* gives the following abstract. With the exception of the case recently brought forward in Dublin, no British society has lately had the subject under consideration. Its importance in British medicine is, nevertheless, well indicated by the fact that the Royal College of Physicians of London has its "leprosy committee," which, in view of the fact that there is increasing evidence respecting the communicability of leprosy, has just recommended a full and searching scientific investigation into the whole matter.

Dr. Abraham demonstrated on a map the wide prevalence of the disease, especially in the British Empire, and remarked that it is no wonder that the subject is coming to the front. He hoped that the inquiry urged by the College of Physicians would be sanctioned by the government, not only to set at rest, if possible, doubtful points regarding the causation of the disease and the desirability of preventive measures, but also to allay a possible emotional scare on the part of the British public. From the insufficiency of data it is difficult to say accurately whether leprosy be really increasing or decreasing in many of the British colonies. In many cases we have to rely chiefly upon general impressions. Even the death returns cannot be depended upon always, for they are frequently, as in Jamaica, uncertified by qualified practitioners; and we must remember the natural and universal tendency on the part of the sufferers and their friends to conceal their affliction. The belief in the increasing spread of leprosy at the Cape of Good Hope was so strong that a leprosy repression act was passed in 1884. From the numerous medical reports which Dr. Abraham quoted there can be little doubt that the disease is really on the increase in South Africa. It probably is spreading, but in a less marked manner, in the West Indies; and on the whole, in India, especially in certain districts.

The articles which are now appearing in the Anglo-Indian press indicate that the public mind is becoming somewhat inflamed over the matter; and that there is some cause may be inferred from the large amount of official attention which has been for some time past directed in India to the matter. Dr. Abraham quoted the late resolution (September, 1888) of the Indian government, stating that a measure of rigorous segregation would be repugnant to public opinion, and recommending for the present the grant of medicine and charitable relief in voluntary hospitals and asylums. A short history of leprosy in Hawaii was then given, the latest information having only just come to hand. He pointed out that, in spite of the efforts at isolation, the disease had enormously increased since 1865. The author gave an account of his visit last year to the Norwegian leper asylums, and gave particulars relating to the treatment of the patients, and the views with which he was favored by Drs. Danielssen, Nickoll, Kaurin, and Daud, who were in charge of the asylums at Bergen, Molde, and Trondhjem. He showed curves indicating the relations between the gradual decrease of the disease throughout the country and the number of patients in the hospitals.

With regard to leprosy in Great Britain and Ireland, he referred to cases he had recently seen in London. Through the kindness of Mr. Larder he was able to exhibit to the Society two fairly typical examples of the chief varieties of the disease, one the "nodular dermal form," and the other the so-called "anæsthetic" form. The latter case was that of a man sixty-four years old, a meat salesman, of English parentage, and born in London. When young he had been a sailor in the Mediterranean and in the Baltic, but had not been out of London for upwards of forty years. Until

six years ago he had always enjoyed the best possible health. The author did not admit that this was a case of *de novo* development, though the period of incubation was extraordinarily long. The germ must have been dormant, like the "mummy" wheat, for nearly forty years.

After referring to the present unsatisfactory nomenclature of varieties, and to the army and navy records of the disease, he, in conclusion, summed up, and, had time allowed, would have adduced arguments in support of the theories that leprosy is caused by the bacillus, that the disease is communicable from person to person, and that segregation is justifiable. Microscopic specimens, prepared by the author, were exhibited, showing the *bacillus leprœ* scraped from the tongue and mouth of a patient, and sections of dermal nodules, anæsthetic skin, nerves, etc. Many of the references were from hitherto unpublished sources, both private and official.

**Death from Electricity.**

A DEATH recently occurred at Brighton, England, from the accidental contact of the conducting wire of the electric lighting apparatus with the neck of one of the employees at a brewery. The deceased was "found dead" in the neighborhood of the fatal electrical conductor, and a report in a local newspaper states that a post-mortem examination revealed perfectly healthy organs, the only abnormality in this case being "a mark half-way round the neck as if grazed by the wire." With the extension of electric lighting, says the *Lancet*, occasional fatalities of this kind are to be expected, and the number of deaths from this cause has already been considerable. In the case recently reported there was, it is to be observed, a slight mark upon the body, and in a case which occurred in 1884 a blister was found upon one of the fingers of the deceased with which contact had been accidentally made by the machine. In other cases there has been no mark whatever, so that we may conclude that the pathological evidence of the cause of death in such cases is almost *nil*. It seems to us of the greatest importance that these accidents should be carefully studied, and it would almost seem to be the duty of the local government board to send a trained pathologist to attend the post-mortem examination of every case which occurs, in order that a careful comparison might be established between the cases, and any points which they might present in common be duly noted. This could only be done by one having considerable accumulated experience, and such experience could only come to one having such opportunities as an official position would give.

The matter is of very great importance, because a cause of death which is, so to say, gradually becoming omnipresent, and which leaves no mark, is tolerably sure to be made use of for criminal purposes, and if there be any certain means of establishing how death took place, a knowledge of this would be the only means of checking the misdeeds of persons with criminal intentions. It generally has happened hitherto that the surrounding circumstances have left no doubt as to the cause of death, but it is not reasonable to suppose that such would always be the case, and if it suited the crafty schemes of a criminal it might very easily be contrived otherwise. In short, there is no doubt that we ought to use every endeavor to increase our exact knowledge of this cause of death, and we can only hope that post-mortem examinations will be carefully made in all cases which occur, and that practitioners will regard it as a duty which they owe to the profession and the public to place upon record the results of such examinations.

CANCER. — A small commune in Normandy, Saint Sylvestre-de-Courcelles, with a present population of only 379, as compared with 500 twenty years ago, has in the eight years 1880 to 1887 lost no fewer than eleven of its inhabitants, between the ages of sixty-two and eighty-three, from cancer, — a proportion of 15 per cent of the total mortality. All but one of the cases were males, and in as many as eight the cancer was seated in the stomach. Such facts have led Dr. Arnaudet, according to *L'Union Médicale*, to conclude that cancer is contagious, and is propagated through the medium of water. It is true, he remarks, that not one of the eleven persons mentioned were water drinkers, but then they drank cider, which is made with the pond water of the district. Dr. Arnaudet thinks this sufficient ground to advocate the use of antiseptics and of boiled water as prophylactics against cancer, as well as against typhoid fever or phthisis.

TYPHUS BACILLI IN WATER. — Several cases of typhoid have recently occurred in a town in the province of Baden, Germany, and it came to light that three of the patients first affected procured their drinking water from the same well. The water was then examined, the strictest precautions being used to prevent infection from other sources. In three days the cultures were found to have developed on an average one hundred and forty thousand colonies to the cubic centimetre. Ten tests had been made, but only in one of these was there found a single colony of typhoid bacilli.

## NOTES AND NEWS.

IT is officially announced that a general national exhibition of agriculture and sylviculture will be held at Vienna, next year, from the 15th of May to the 15th of October. The exhibition is to include the following international sections: (1) machinery and implements used in agriculture, sylviculture, and the industries cognate to them, such as horticulture, viticulture, hop-growing, bees, silk, fishing, and hunting; (2) artificial and auxiliary branches of agriculture, such as artificial manures, remedies for sick animals, etc.; (3) models, plans, designs, and statistical information respecting agriculture and forestry; (4) inventions dealing with the utilization of waste material; (5) information and suggestions respecting the food supply of large cities.

— The fifty-ninth annual meeting of the British Association will be held at Newcastle-on-Tyne, beginning on Sept. 11 and 12; and the Durham, Northumberland, and Newcastle Botanical and Horticultural Society has arranged to hold its autumn meeting and exhibition at the same time and place. The local committee have spared no efforts to make the arrangements for the meeting as complete as possible, and their labors have been greatly lightened by the fact that many fine buildings suitable for the purposes of the association have been erected since it held its last meeting at that place in 1863. The reception-rooms, occupying a central position with respect to the various section rooms, will be located in the new buildings of the University of Durham College of Medicine, in which building a writing-room and ladies' drawing-room will be provided, and special rooms for the use of the officers of the association. The Cambridge Drill Hall, near the reception-room, is to be fitted up for a luncheon-room. Sections A and B will meet in the new buildings of the College of Science, opened in November last; and in the chemical laboratory of this college it is intended to bring together a series of exhibits illustrating the chemical and allied manufactures of the district. The general meetings of the Association will be held in St. George's Drill Hall. The Natural History Museum, opened in 1884, in which building is Mr. Hancock's unique collection of British birds, will be used for the two *soirées*, the first to be given by the mayor and corporation, and the second by the local committee. A guide-book, arranged in three sections, has been prepared for the occasion, dealing respectively with the history and topography, the geology and natural history, and the industries of the district.

— The Royal Society of New South Wales offers its medal and a prize of £25 for the best communication (provided it be of sufficient merit) containing the results of original research or observation upon each of the following subjects, to be sent in not later than May 1, 1889: "Chemistry of the Australian Gums and Resins;" "Aborigines of Australia;" "Iron Ore Deposits of New South Wales;" "List of the Marine Fauna of Port Jackson, with Descriptive Notes as to Habits, Distribution, etc." The same offer is made for the best communications on the following subjects, to be sent in not later than May 1, 1890, "Influence of the Australian Climate (general and local) in the Development and Modification of Disease;" "Silver Ore Deposits of New South Wales;" "Occurrence of Precious Stones in New South Wales, with a Description of the Deposits in which they are found;" also on the following, to be sent in not later than May 1, 1891, "Meteorology of Australia, New Zealand, and Tasmania;" "Anatomy and Life History of the Echidna and Platypus;" "Microscopic Structure of Australian Rocks." The competition is in no way confined to

members of the society, nor to residents in Australia, but is open to all without any restriction whatever, excepting that a prize will not be awarded to a member of the council for the time being; neither will an award be made for a mere compilation, however meritorious in its way. The communication, to be successful, must be either wholly or in part the result of original observation or research on the part of the contributor. The society is fully sensible that the money value of the prize will not repay an investigator for the expenditure of his time and labor, but it is hoped that the honor will be regarded as a sufficient inducement and reward. The successful papers will be published in the society's annual volume, and fifty reprint copies will be furnished to the author free of expense. Competitors are requested to write upon foolscap paper — on one side only. A motto must be used instead of the writer's name, and each paper must be accompanied by a sealed envelope bearing the motto outside and containing the writer's name and address inside. All communications are to be addressed to the honorary secretaries, A. Liversidge, and F. B. Kyngdon.

— The English Consul at St. Petersburg says that naphtha residuum is being more and more employed as fuel in Russia. All the steamers of the Caspian Sea, and many of those plying on the Volga, have for some time past used it as fuel. At the present time manufactories and railways are adopting it in the place of wood and coal. It is also being utilized for domestic purposes in stoves of special construction, ingenious specimens of which were exhibited last year at the St. Petersburg Naphtha Products Exhibition. By the employment of this new combustible a considerable saving is effected under the head of fuel. Some large manufactories in Moscow and its immediate neighborhood employ naphtha residue in their furnaces, because, in addition to its great cheapness, it possesses the advantage of occupying less space than wood or coal for storage. It is kept underground in large cisterns communicating by pipes with the furnaces, and owing to this method of storage it is also less exposed to danger from fire. It is established that the cost of naphtha dregs as fuel is about 35 per cent less than that of wood and coal, and this, too, at Moscow, which is 1,500 miles distant from the source of supply at Baku, whence naphtha dregs are conveyed by water to Nijni Novgorod, and beyond by rail to Moscow. Several manufacturers of the province of Vladimir have also adopted the new combustible, and the railway lines existing in the Tambov and Riazan provinces are on the point of doing the same. During 1888, 867,857 tons of naphtha residue were transported from Baku up the Volga, for use in the interior provinces and in those bordering the Volga. It is expected that in 1889 the supply will exceed 1,125,000 tons. In the northern zone of the empire, wood will, it is stated, hold its own as fuel for some time to come. It is specially in the central, south-eastern, and eastern provinces of Russia that the employment of naphtha residuum as a substitute for both wood and coal promises to attain great proportions.

— At the Yale Observatory, during the summer months of 1888, Dr. Elkin completed the measures with the heliometer for the triangulation of the region near the north pole. The reductions of these measures are well advanced. In October they commenced the series of observations on the minor planet Iris in conjunction with the observatories at the Cape and at Leipzig. The autumn months were unfortunately by no means as favorable as usual, and they only secured measures on thirty-four of the sixty-five planned nights. They undertook at the same time a further series for the diurnal parallax of the planet. They are now commencing a similar series on the planet Victoria, to continue through until September; and a third series on Sappho is to occupy them in September and October. As, in addition to the heliometers used for Iris, those at Bamberg and Göttingen will probably co-operate this year, the three series together will doubtless furnish a very accurate value of the solar parallax. The heliometer has also been employed in some supplementary series on the parallaxes of the northern brighter stars, Mr. Hall having taken up Procyon and $\alpha$ Aquilæ, and Dr. Elkin, Vega and $\alpha$ Leonis. During the winter, Mr. Hall completed the reductions of his work on the orbit of Titan, the results of which are in very satisfactory agreement with those of Bessel and Hermann Struve. The value found for the mass of Saturn is 1 : 3500.5 of the solar mass, Bessel's revised value being 1: 3502.5, and Struve's 1: 3498. Dr. Elkin spent the winter months in the West, observing the total solar eclipse of Jan. 1, 1889, at Winnemucca, Nev., under very favorable circumstances. He used the finder of the heliometer for a general view of the corona, and, with the low power and large field of about 4°, could trace the equatorial streamers to a distance of about 100′ on either side from the limb. He devoted a part of the time near the beginning and end of totality to a careful scrutiny of a small portion of the outer rays of the corona with a view of detecting any possible rapid changes in the same; but during the 90 seconds of observation, and in the portion he looked at, nothing of this nature occurred.

— In his annual report on education in Hong Kong, Dr. Eitel, the government inspector of schools, says, according to *Nature*, that the total number of educational institutions of all descriptions known to have been at work in the colony of Hong Kong during the year 1888 amounts to 206 schools, with a grand total of 8,717 scholars. More than three-fourths of the whole number of scholars — that is to say, 6,728 — attended schools (99 in number) which are subject to government supervision, and either established or aided by government in some form or other. The remainder — viz., 107 schools, with 1,989 scholars — are private institutions entirely independent of government supervision, and receiving no aid from public funds, except that they are exempt from payment of rates and taxes.

— M. Taupin, who was recently despatched by the Governor-General of French Indo-China to the Laos States on an exploration, thus sums up the results of his labors: — "I have studied the language and system of writing of the Laos — that is, of the only population in the world possessing a graphic-alphabetical system. Of this there has been up to the present no positive knowledge. It was only known that the Laotian language and writing were somewhat similar to those of Siam. The language is spoken by about four millions of people. I have collected interesting information relating to the natural history of these regions, and much commercial information. . . . I have made numerous meteorological observations, and taken a large number of anthropometrical measurements according to the Broca system."

— At a recent meeting of the Genevan Society of Physics and Natural History, says *Nature*, M. Mallet exhibited two balls of almost perfect sphericity, about four inches in diameter, one black, and of vegetable origin, the other white, and of mineral origin, but both produced by a mechanical movement. The black ball had been found with another in a piece of oak which had long served as the shaft of a mill-wheel. A cavity having formed in the wood, through disease or the work of some insect, the dust of the wood, with acquired moisture, had been rolled into this spherical form, growing in size, like a snowball (a slow process of many years probably, as the wheel was very old). The white ball, a calcareous pebble, was found with many others in a grotto traversed by a torrent which flowed into the Rhone.

— The twelfth annual meeting of the American Society of Microscopists met at Buffalo, N.Y., on Aug 20, in the Library building. On the opening day, Hon. Davis F. Day, President of the Buffalo Society of Natural Sciences, delivered the opening address, which was followed by a brief address by President Lewis of the Microscopists. The morning session concluded with a paper on "A Microscope Stand," by Professor P. J. Burrill. The afternoon's session consisted of routine business and the reading of papers by Professor W. A. Rogers, "On a New Method of Determining Temperature from the Readings of Mercurial Thermometers;" by Professor S. A. and Mrs. Susannah Gage on "Staining and Permanent Preservation of Histological Elements Isolated by Means of Nitric Acid or Caustic Potash;" by Dr. Lucien Howe, on "Microscopic Growths on the Normal and Diseased Eye;" by Professor D. S. Kellicott, on "A New Rotiferion;" and by Professor W. A. Rogers, on "A Practical Method of Securing Copies of the Standard Centimeter Designated Scale A." The society's annual exhibition was held on Thursday evening.

— Count Joseph Florimond Loubat of New York has given to the Academy of Sciences of Berlin $5,500, as a fund the income of which is to be given in prizes every five years. Count Loubat has given the academy also money to be expended on a first set of prizes in 1891. The special object of this gift is to encourage anthropological studies of matters pertaining to North America. For the prize of $750, to be awarded in July, 1891, articles published between July 1, 1884, and July 1, 1889, will be accepted for competition, provided they are sent to the Academy before July 1, 1890. The subject for this first prize will be the colonization of America by Europeans up to the present day.

— Elias Loomis, Professor of Natural Philosophy and Astronomy at Yale, died at New Haven, Aug. 15, 1889, of Bright's disease. He was born at Wilmington, Conn., Aug. 7, 1811. His education began at a tender age, and at the age of nineteen he graduated from Yale. Three years later he was appointed a tutor at that college, a post he retained for three years. A year was then spent in Paris, after which Loomis was elected to a professorship of mathematics and physics in Western Reserve College in Ohio. In 1844 he accepted a similar position in the University of the City of New York; and it was during his incumbency of this chair that Professor Loomis wrote the many text-books on mathematics, astronomy, natural philosophy, and meteorology that have made his name so well known. An extraordinary success attended this series, the total circulation coming to more than 500,000 copies. Some of these books were used abroad, and translations were made into even Chinese and Arabic. In 1860 Professor Loomis returned to Yale, where he remained till his death, devoting much time to his contributions to meteorology aside from his work as a teacher.

— The Delegates of the Clarendon Press have the following works ready for early publication: an edition, with notes for students, of Tertullian's "Apology," by Mr. T. H. Bindley of Merton College; "Selections from Burns," by Mr. J. Logie Robertson (uniform with "Selections from Clarendon," just published); Mr. Oliver Aplin's "Birds of Oxfordshire." In mathematics they will issue shortly the second volume treating of Electro-Dynamics of Messrs. Watson and Burbury's "Mathematical Theory of Electricity and Magnetism," and a new edition of the fourth volume on the dynamics of material systems (which has long been out of print) of Professor Bartholomew Price's "Treatise on Infinitesimal Calculus."

— The Washington Life Insurance Company reports a decided tendency to increase of suicides in recent years. Shooting is the means selected in about one-half the cases. It is more frequent among the young than among the old, and on this account the company's *a priori* expectation had been in the direction of a decrease in this cause. This expectation has been balked, and the writer of the report goes so far as to say that the increase in recent years has not been purely a matter of accident, and that the decisions of the courts have not been such as to discourage suicide among the insured.

— According to the London *Electrical Review* Dr. J. A. Fleming has designed an incandescent lamp slide-rule, by which any of the calculations with regard to lamps may be performed with readiness. Thus if we have given the current, the terminal volts, and the candle-power, the scale shows the watts per candle; or given the watts per candle-power, and the candle-power, we can find the current corresponding to any voltage; or from the volts and current we can read off the hot resistance; and finally, when we know the volts and current when the lamp is burning at normal brilliancy, the rule shows the approximate candle-power. We imagine that electric light engineers and their assistants will find this little device, which is issued by the Edison-Swan Company, very handy.

— The agents of the California State Board of Horticulture, says *Garden and Forest*, are now raising the Australian ladybird in such numbers that colonies are furnished to all applicants whose trees are infested with the cottony cushion scale. These imported insects have proved effective destroyers of the scale, and there seems to be a reasonable ground for hope that this most serious enemy of the orange, the lemon, and other trees of that family can now be held in check.

— Birds of the crow-tribe, especially the raven, the carrion-crow, the hoodie, and the magpie, are in ill-repute in England for stealing eggs, and, when opportunity serves, for murdering chickens, ducklings, etc., but in the north of Norway these depredators are much bolder. They will even attempt to carry away the eggs and the young brood of the eider-duck, and too often succeed in their foray; but if the drake is near at hand, they are frequently defeated. He siezes the crow by the wing or neck and plunges down with him into the sea. Being a good diver he feels no inconvenience, whilst the carrion-crow, however brave and strong in the air, is helpless in the water, and the end of the struggle is soon shown by his lifeless body floating on the surface. Sometimes even the raven is disposed of in the same manner. It is a curious fact that young sea-fowl, when swimming or diving in waters which literally swarm with cod, halibut, and other greedy and hungry fishes, are not often snapped up and swallowed. Yet veteran lobster fishermen, no small part of whose life has been spent in disembowelling such fishes, declare that they never find a young bird in the stomach of their prey.

— In commenting on the behavior of the machinery of the British war-ships during the recent naval display at Spithead, *Engineering* says that such a complication of machinery crowded into so small a space can only be run with success at the high duty demanded in war-ships by means of the most skilled attention. Want of room adds immensely to the difficulty of attending to machinery, and it is only by men being thoroughly conversant with all the ways of a ship that they can hope to keep things in good going order. We have nothing but admiration for the officers and men of the engineering branch of the navy, nevertheless there was perhaps not a single ship in all the vast fleet collected last week at Spithead which had a fairly competent engine-room staff. The reason is that the complements in many cases were not filled up, and even if they were filled up, the men are too new to the ships to know their way about. We can quite understand the fervour with which the chief engineer of one our leading armour-clads exclaimed, "Thank God they are *peace* manœuvres and not war manœuvres!" This war vessel was one-third short of her proper complement of artificers, and only the chief amongst the officers knew his way properly about the engine-room, and that was quite an accident.

— The trustees of the Hoagland Laboratory make the following announcement. Dr. George M. Sternberg, U.S.A., will continue as general director of the laboratory; George T. Kemp, Ph.D., Johns Hopkins University, will be associate director of the departments of physiology and experimental therapeutics; and Dr. B. Meade Bolton has been appointed director of the department of bacteriology, assuming charge of that department in September.

— At a meeting of the Russian Mineralogical Society, K. D. Chrustschoff, it is said, demonstrated the existence of a new metal which he has just discovered and named "russium." The metal approximates closely in its properties to thorium, and its existence was predicted by Mendeléeff.

— In a letter to *Science Gossip*, Mr. T. A. Dukes writes: "I have always understood that a thunder-clap was a necessary result of the electrical discharge which caused a lightning flash, but last night, while watching those splendid natural fireworks — a thunderstorm — I thought there seemed to be many more flashes than thunder-claps. So, at the height of the storm, as indicated by the loudness of the thunder, and the position of the lightning nearly overhead, I began to count them, and while there were thirty-nine flashes there were only fourteen claps. Still unconvinced, I, with a pencil and paper, recorded each as it occurred — fifty-five flashes to nineteen claps; and again, during five minutes, there were fifty-six flashes to twenty-three claps, and yet I tried to favor the thunder. It was not the distant 'summer' lightning, but 'forked' lightning, some flashes consisting of as many as 4,075 simultaneous zigzag cracks in heaven; indeed it seemed to be steadily lightning all the while, yet the thunderings, though loud, were not prolonged. I would be obliged if some one would explain this, or show me my error. Many of the flashes were behind some clouds, for they lighted up their background and left them in relief; could it be that these clouds reflected the sound so that it did not reach me?"

# SCIENCE:

*A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.*

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OF THE PROGRESS toward the World's Fair of 1892, we have to report this week the first meeting of the finance committee. Of the twenty-five appointed on the committee by Mayor Grant, seventeen responded to their names on the call of the roll. These were William L. Bull, Calvin S. Brice, August Belmont, Samuel D. Babcock, Robert Dunlap, Henry B. Hyde, John H. Inman, Frederick A. Kursheedt, Jay Gould, Eugene Kelly, John McKesson, Hermann Oelrichs, William Rockefeller, Charles Stewart Smith, William Steinway, J. Edward Simmons, Jesse Seligman, Oswald Ottendorfer, the absentees being C. P. Huntington, H. O. Havemeyer, Morris K. Jesup, Ogden Mills, Joseph J. O'Donohue, Elliott F. Shepard, and Cornelius Vanderbilt. The last named sent a telegram expressing regret at his inability to attend the meeting, pledging his endorsement in any action taken, and promising to take a hand in the enterprise as early as possible. A motion by Mr. Bull to add the name of Mr. J. Pierpont Morgan was promptly carried. Mr. Babcock was elected chairman by a unanimous vote. He expressed the hope that the committee would be harmonious in its action, as had been the Plan and Scope Committee of the Centennial. He had been connected with that committee for eighteen months and they never had had a divided vote. The chairman suggested that the first business should be the election of a treasurer. His suggestion was promptly adopted, and J. Edward Simmons was chosen. The subject of permanent secretary was next discussed. Secretary Wilson of the Chamber of Commerce was named by Mr. Smith and endorsed by Mr. Simmons. Mr. Belmont thought it was not well to act hastily, and believed it was of far more importance to get an executive committee of five or seven members. This committee, he said, could name a secretary, consider all the plans submitted to the Mayor, and be accountable to the general finance committee. Mr. Belmont finally made a motion for the immediate appointment of an executive committee of five by the chairman, and it was seconded by Mr. Bull. Mr. Smith withdrew his motion, and after some discussion the motion of Mr. Belmont was carried. Mr. Babcock named this executive committee: Messrs. Belmont, Morgan, Vanderbilt, Smith, Inman. On motion of Mr. Smith, Chairman Babcock and Treasurer Simmons were added to the committee. At the suggestion of Mr. Belmont, the chairmanship of the executive committee was transferred to Mr. Morgan. Mr. Belmont declared that his health would not permit him to do justice to the place. Mr. Smith offered the use of the Chamber of Commerce to the committee, and the place being convenient, it was accepted with thanks. The committee adjourned until 11 A.M. Wednesday at the Chamber of Commerce.

At the last meeting of the American Institute of Electrical Engineers it was decided to appoint a committee of fifteen to form a plan of organization for an international electrical convention to be held in this city coincident with the World's Fair of 1892. Secretary R. W. Pope was instructed to inform President Mascart of the electrical conference at Paris of this action, and to suggest that the unfinished work of the present conference be taken up at the proposed conference of 1892. The following were elected delegates to represent the institute at the Paris conference now in session: Thomas A. Edison, E. Wilbur Rice, jr., Carl Hering, Joseph Wetzler, and Nikola Tesla. All of them are now in France or on the way there. President Elihu Thompson will in a few days announce his appointments on the committee of fifteen and the work of organization will then be taken up. An invitation will be extended to all the electrical organizations of the country to participate in the proposed international conference.

## ORGANIZATION OF THE AGRICULTURAL EXPERIMENT STATIONS.

THE Office of Experiment Stations in the Departmant of Agriculture was established Oct. 1, 1888. The Department can aid the stations in their relations to each other, in their use of the results of research, and in their connection with the agricultural public. To be first among the stations, the department should be the servant of them all. It should exercise not dictatorship, but leadership. Its influence should be powerful in bringing the stations together and in co-ordinating their work; in making the fruits of other research and experience, past and present, at home and abroad, available to them; in prosecuting lines of pioneer research which will in a measure relieve the stations of a difficult but necessary task, and enable them to apply their energies more fully and successfully to the study of the questions which bear directly upon the practice of agriculture, and will at the same time prepare the way for the abstract inquiry which earnest station workers aspire to, but which the public have not sufficiently learned to appreciate; in collating, condensing, and distributing their results, and in helping to carry the practical outcome to the farmer in a form in which he will appreciate and use it.

It is vitally important that the highest scientific ideal be maintained, and every effort be made toward its realization. The future usefulness of the stations will depend upon what they discover of permanent value, and this must come largely from the most abstract and profound research. To forget this will be fatal. The stations must also remember that it is their office not only to experiment, but to teach; that it is their duty to gather information as well from accumulated stores as from the fields in which they are working, and to bring it not "down to the farmer," but home to him. By thus using their most honest and earnest effort to

help the farmer, they will secure from him and from the public at large the support they need for their highest work.

Unquestionably the stations ought to make practical experiments in the study of the problems before them. But in the long-run, those stations will do best that plan their work most philosophically, and the prosperity of the enterprise as a whole will be proportioned to its success in the discovering of the laws that underlie the right practice of agriculture.

In brief, the ultimate success of the stations will depend upon the discovery of principles. This is accomplished only by patient, profound, costly research, no small part of which has to do with the finding-out of the best methods of investigation of special problems. But while this work is essential, the stations are confronted with the necessity of doing what will directly and immediately help the farmer. The need and value of abstract research are not understood. To show its usefulness and help, prepare the way for the stations to prosecute it, and at the same time do some of the things that are most immediately and pressingly needed in these directions, is one of the important ways in which the department may aid the experiment station enterprise.

## THE NEW BUILDINGS OF THE SORBONNE, PARIS.

THE people of France have never doubted the utility and necessity of the Sorbonne. During the long and splendid history of the Sorbonne, to quote from *Nature*, they have had ample experience of the value of a great teaching body in the capital; and the result is that this is one of the institutions in which men of all parties take a common pride.

So long ago as 1855 it was decided that new buildings for the Sorbonne should be erected, but the scheme was not really complete until 1881. It was then estimated that the expense would be 22,000,000 francs — a formidable enough sum, but one which caused no serious difficulty, as the city readily undertook to contribute half of it. The foundation was laid in 1885, and now a considerable part of the work is finished. This was opened on Aug. 5, in the presence of President Carnot, and the ceremonies on the occasion may be regarded as affording fresh evidence of the enthusiasm felt by educated Frenchmen for all that represents and tends to develop the highest intellectual life of the nation. Every university had been asked to send delegates elected by the students to the celebration; and the State, and the city of Paris, agreed to look upon them as their guests during the ten days of festivity in honor of science. This part of the programme was well carried out, arrangements having been made with different hotels to board and lodge the foreign visitors at the expense of the Hôtel de Ville and the Ministry of Public Instruction. Russia and Germany did not accept invitations, but the universities of Great Britain, of the Scandinavian countries, of Belgium, Holland, Greece, Switzerland, Italy, Spain, and the United States were represented. There were about 700 delegates from these countries, besides a large number who went at their own expense.

The exercises began on Sunday evening with a gala performance of "Faust" at the Opera House, which the President attended. On Monday the 5th, 3,000 persons assembled in the new amphitheatre, an immense hall adorned with frescoes. Each delegation had a standard-bearer carrying the flag of his nation, and the members of the various groups were warmly greeted by the public as they advanced to the places appointed for them. At 3 o'clock President Carnot arrived, and took his seat on the platform, surrounded by ambassadors, statesmen, and academicians. M. Ferry, as the minister who made the arrangements for the enlargement, was much cheered.

M. Gréard, rector of the Academy, made the first speech. He sketched the history of the Paris University, extolled the events of 1789, and described study as a common fatherland, which had brought together delegates from nearly all the European and American universities. M. Hermite next reviewed the mathematical teaching of the Sorbonne since 1808. M. Chautemps, President of the Municipality, vindicated democracy from the imputation of indifference to culture, and claimed credit for the body represented by him for having founded a chair of French revolution history and a chair of evolution. M. Fallieres, Minister of Education, dwelt on the efforts and sacrifices of the republic for the diffusion of culture. He referred to the moribund condition of the universities on the eve of the Revolution, and the want of cohesion between the colleges afterwards established, and eulogized the individuality now developed by the provincial universities.

## THE MARINE CONFERENCE AT WASHINGTON.

THE following is the programme of subjects to be considered at the International Marine Conference which will meet at Washington on Oct. 16 of this year.

In General Division 1 will be considered marine signals or other means of plainly indicating the direction in which vessels are moving in fog, mist, falling snow, and thick weather, and at night; also rules for the prevention of collisions and rules of the road: —

1. Visibility, number, and position of lights to be carried by vessels, — (*a*) steamers under way; (*b*) steamers towing; (*c*) vessels under way, but not under command, including steamers laying cable; (*d*) sailing vessels under way; (*e*) sailing vessels towing; (*f*) vessels at anchor; (*g*) pilot vessels; (*h*) fishing vessels.

2. Sound signals, their character, number, range, and position of instruments, — (*a*) for use in fog, mist, falling snow, and thick weather as position signals; for steamers under way; for steamers towing; for sailing vessels under way; for sailing vessels towing (these signals to show the approximate course steered, if possible); for vessels at anchor; for vessels under way, but not under command, including steamers laying cable; (*b*) for use in all weathers as helm signals only; for steamers meeting or crossing; for steamers overtaking; for steamers backing; (*c*) whether helm signals shall be made compulsory or remain optional.

3. Steering and sailing rules, — (*a*) sailing vessels meeting, crossing, overtaking, or being overtaken by each other; (*b*) steamers meeting, crossing, overtaking, or being overtaken by each other; (*c*) sailing vessels meeting, crossing, overtaking, or being overtaken by steamers; (*d*) steamers meeting, crossing, overtaking, or being overtaken by sailing vessels; (*e*) special rules for channels and tideways where no local rules exist; (*f*) conflict of international rules; (*g*) uniform systems of commands to the helm; (*h*) speed of vessels in thick weather.

In General Division 2 consideration will be given to regulations to determine the seaworthiness of vessels, — (*a*) construction of vessels, (*b*) equipment of vessels, (*c*) discipline of crew, (*d*) sufficiency of crew, (*e*) inspection of vessels, (*f*) uniform certificates of inspection; in General Division 3 attention will be paid to the draught to which vessels should be restricted when loaded, and uniform maximum load mark; and in General Division 4 will be discussed uniform regulations regarding the designating and marking of vessels, — (*a*) position of name on vessels, (*b*) position of name of port of registry on vessels, (*c*) size of lettering, and (*d*) uniform system of draught marks.

In General Division 5 saving life and property from shipwreck will be considered: —

1. Saving of life and property from shipwreck at sea, — (*a*) duties of vessels after collision; (*b*) apparatus for life-saving to be carried on board ship (life-boats, life-preservers, life-rafts, pumps, and fire-extinguishing apparatus); (*c*) the use of oil and the necessary apparatus for its use; (*d*) uniform inspection as to (*b*) and (*c*).

2. Saving of life and property from shipwreck by operations from shore, — (*a*) organization of and methods employed by life-saving institutions; (*b*) the employment of drilled and disciplined crews of life-saving institutions; (*c*) the maintenance of a patrol upon dangerous coasts by night and during thick weather by day, for warning off vessels standing in danger, and for the early discovery of wrecks; (*d*) uniform means of transmitting information between stranded vessels and the shore; (*e*) life-boats, life-saving apparatus, and appliances.

3. Official inquiries into causes and circumstances of shipwrecks aud other casualties.

In General Division 6 will come, necessary qualifications for officers and seamen, including tests for sight and color blindness, — (*a*) a uniform system of examination for the different grades; (*b*) uniform tests for visual power and color blindness; (*c*) general knowledge of methods employed at life-saving stations; (*d*) uni-

form certificates of qualification; in General Division 7, lanes for steamers on frequented routes, — (*a*) with regard to the avoidance of steamer collision; (*b*) with regard to the safety of fishermen; in General Division 8, night signals for communicating information at sea, — (*a*) a code to be used in connection with the International Code Signal Book; (*b*) or a supplementary code of limited scope to convey information of special importance to passing vessels; (*c*) distress signals; and in General Division 9, warnings of approaching storms, — (*a*) the transmission of warnings; (*b*) the uniformity of signals employed.

General Division 10 will cover reporting, marking, and removing dangerous wrecks or obstructions to navigation, — (*a*) a uniform method of reporting and marking dangerous wrecks and derelicts; (*b*) the division of the labor, cost, and responsibility among the several maritime nations, either by geographical apportionment or otherwise; of the removal of dangerous derelicts, and of searching for doubtful dangers with a view of removing them from the charts. General Division 11 will take in notices of dangers to navigation, and notices of changes in lights, buoys and other day and night marks, — (*a*) a uniform method of taking bearings, of designating them (whether true or magnetic), and of reporting them; (*b*) a uniform method of reporting, indicating, and exchanging information by the several maritime nations, to include the form of notices to mariners; (*c*) a uniform method of distributing this information. General Division 12 will be devoted to a uniform system of buoys and beacons, — (*a*) uniformity in color of buoys; (*b*) uniformity in numbering of buoys; and General Division 13 to the establishment of a permanent international maritime commission, — (*a*) the composition of the commission; (*b*) its powers and authority.

The programme, as above drawn up, is submitted over the signatures of Rear Admiral S. R. Franklin, U.S.N.; Commander W. P. Sampson, U.S.N.; S. T. Kimball, General Superintendent of the Life Saving Service; J. W. Franklin, master marine; J. W. Shackford, master, merchant marine; and W. W. Goodrich, counsellor-at-law.

The Hydrographic Office desires to obtain the opinions and suggestions of interested parties on the various subjects to be considered, with a view to assisting members of the conference in formulating satisfactory rules. It is hoped, therefore, that those whose opinions are likely to have weight on any of the subjects mentioned, may give the benefit of their knowledge or experience.

## BOOK-REVIEWS.

*Thermodynamics of the Steam Engine and other Heat Engines.* By CECIL H. PEABODY. New York, Wiley. 8°. $5.

THE author of this book is associate professor of steam engineering in the Massachusetts Institute of Technology, and the book is intended mainly for the use of students in that and similar technical institutions. He presents in a clear manner, and with a minimum of mathematical expression, the general theory of thermodynamics; and his treatment of the properties of gases and vapors, and of the injector, presents several novel and interesting features, especially in the comparisons with experiments. More novel still, and more valuable to the student who intends to adopt steam-engineering as a profession, is the author's treatment of the steam engine. He has considered it advisable to leave untouched all approximate theories based upon the assumption of adiabatic changes of steam in the cylinder of the engine, making instead a systematic study of actual tests of engines in use, for which purpose a large number of test records have been collected, arranged, and compared. This will enable the student to learn what is actually known on the subject, and will point out to him the direction in which future investigations will give the best results, as well as show him how and where improvements may be made.

It will be gathered from the foregoing that this book differs, in some parts, either in substance or in manner of presentation, from other text-books on the subject; but in general, commonly accepted methods have been followed. The formal presentation of thermodynamics is the same as that employed by most authorities, and presents clearly the many difficulties of the subject, besides making plain the processes employed.

The author gives special attention to the investigations of the action of steam in the cylinder of an engine, considerable space being given to the researches made by Hirn, as well as to the experiments which provided the basis for them. Directions and instructions are given for the designing and construction of simple and compound engines, and also for making accurate tests of their efficiency. Chapters are given on air-compressors and refrigerating machines, which important subjects may profitably be studied in connection with the theory of thermodynamics.

Though this volume, like all similar text-books, is largely an adaptation for a special educational purpose of the work of other authors and experimenters, more than a general acknowledgment of indebtedness to them would not under the circumstances be deemed necessary; still Professor Peabody has given references in foot-notes wherever direct quotations have been made, which will aid students materially in making more extended investigations

## AMONG THE PUBLISHERS.

D. APPLETON & CO. call attention to the fact that "Christianity and Agnosticism" has gone into a second edition.

— Messrs. Houghton, Mifflin, & Co. announce for early publication, "Literary Landmarks: A Guide to Good Reading for Young People, and Teachers' Assistant." By Mary E. Burt, Teacher of Literature, Cook County Normal School, Englewood, Ill. 152 pages. Cloth, 75 cents.

— The *Modern Science Essayist* for July contains an essay on the "Evolution of Society," by James A. Skelton. In the August number, J. Sidney Sampson discusses the "Evolution of Theology."

"Useful Hints on Steam" is the title of a very attractive little volume of nearly a hundred pages, written and published by E. E. Roberts of 107 Liberty Street, New York. It is written in a popular vein, and is intended for beginners.

— Charles H. Kilborn, Boston, have just ready "Round the World with the Poets," selected and arranged by Mary Cate Smith and Sarah C. Winn, intended to afford a series of review exercises in the study of geography. The quotations are arranged beginning with physical features and then giving longer poems relating to particular countries, mountains, rivers, cities, etc. These are followed by an illustrative tour, giving in selections from well-known authors an interesting journey around the world.

— The September number of *Harper's Magazine* will contain two articles by Theodore Child, one describing the American fine art exhibition at the Paris Exposition, which Mr. Child does not hesitate to say is one of the strongest and most interesting of all the foreign departments, and the other giving features of Moscow life that escape the eye of ordinary travellers. In the same number Edmond de Pressensé gives an outline of the religious movement of the present day in France; "London Mock Parliaments," by John Lillie, illustrated by Harry Furness; the distinguished caricaturist, Caran d'Ache, will have a series of sketches of dogs in the "Editor's Drawer;" and Lynde Palmer contributes a story about electricity called "The Pendragon Trial."

— The next volume in the Badminton Library to be published in the autumn, is "Fencing, Boxing, and Wrestling," written by Messrs. Walter H. Pollock, F. C. Grove, Walter Armstrong, E. B. Mitchell, and M. Prévost. This will be followed later by "Golf," to which Mr. Horace Hutchinson, Mr. A. J. Balfour, and Sir William Simpson (among others) will contribute.

— In the September *Scribner's* Lieut. W. W. Kimball, U.S.N., United States Inspector of Ordnance, will describe the various types of magazine rifles which have been adopted by the leading European armies, including the Mannlicher, Hotchkiss, Lee, Mauser, and Vetterli. A number of illustrations will show the contrivances by which the cartridges are fed to the rifle. Andrew Lang will write of Alexandre Dumas. Harold Frederic will begin a new serial romance of the Mohawk Valley in the days of the French and Indian wars and the Revolution. H. G. Prout's article on "Safety in Railway Travel," is the twelfth and last in the very successful railroad series. It is announced that these articles, with

many additions to the text and illustrations, will be collected in a very handsome volume, to be published by Charles Scribner's Sons early in the fall.

— George H. Ellis, Boston, will publish shortly a book of social essays entitled "Problems in American Society," by Joseph Henry Crooker, the author of "Jesus Brought Back." The book will deal with the problems of charity, temperance, political conscience, moral and religious instruction in public schools, and also the problem of solving the question at issue between the Catholic Church and the secular schools.

— G. P. Putnam's Sons have published "Great Words from Great Americans," a neatly gotton up little book giving the Declaration of Independence, the Constitution of the United States, Washington's and Lincoln's inaugural and farewell addresses, etc.; and "Seven Thousand Words Often Mispronounced," by William H. P. Phyfe.

— W. W. Pasko, 19 Park Place, New York, has issued the first number of *Old New York*, a journal relating to the history and antiquities of New York City. Mr. Pasko is also the editor. The periodical is intended to cover the entire range of events "from the discovery of the river and bay down to a period within the recollection of middle-aged persons." It will be published in monthly numbers containing sixty-four pages each. The editor invites the co-operation of all those interested and will be glad to be furnished with material. "Nothing will be inserted for sensation; truth, and truth alone, will be his purpose."

— A remarkable chapter of Napoleonic history will appear in the September *Century*, consisting of letters and journals of British officers describing Napoleon's voyage to Elba, also to St. Helena. The first part of the article is a letter written by Captain Ussher, who commanded the "Undaunted," which took the exile to Elba; the last part is by Lieutenant Miles, of the "Northumberland," and consists partly of a diary which the young lieutenant kept while on the way to St. Helena in the same ship with the ex-emperor. Napoleon talked quite freely about some of his plans — especially with regard to the French navy — told a number of stories, and explained various points in his own career.

— D. Appleton & Co. announce for early publication "European Schools," by L. R. Klemm, which will be fully illustrated and included in the International Education Series; "A First Book in American History," by Edward Eggleston, which will be beautifully illustrated by eminent American artists; and Youmans' "Class-Book of Chemistry," thoroughly revised by Dr. W. J. Youmans, a brother of the author, and made quite up to date by including the latest developments of the science.

— Sir Charles Dilke is engaged upon a new work, entitled, "Problems of Greater Britain." "Though covering in some respects the same ground as 'Greater Britain,'" says the *Athenæum*, "it will not be, like that book, a record of travel, but a study of comparative politics and a complete survey of the empire. Special attention will be paid to the question of Indian frontier defence, to the situation in Canada and South Africa, and above all to the many important problems which concern the present and future of Australia." The book will be published by Messrs. Macmillan & Co. in January.

— A "floral campaign," for the choice of a national flower, to correspond with the rose of England and the lily of France, is now in progress in many parts of the country, and is arousing considerable interest and discussion among flower loving patriots. Prang & Co. of Boston, who started the campaign, have just issued a little volume containing pictures of the two favorite candidates, the mayflower and the golden-rod, two poems reciting the claims of each, a history of the campaign, and a postal ballot for the use of those who wish to vote on the subject. The polls will close on Dec. 31, this year, when the results will be published. The result of the voting so far is as follows. For the golden-rod, 67 per cent;

for the mayflower, 21 per cent; the laurel, 3½; dandelion, 3; sunflower, 1; and daisy, 1.

— The *Fortnightly Review* for August opens with a paper on "Mr. Gladstone and the Civilized World," by Karl Blind, in which the writer reviews Mr. Gladstone's criticisms on home rule in other countries and applies the lessons to Ireland. Dr. Joseph Thomson, the noted explorer, writes on "Downing Street *vs.* Chartered Companies in Africa," giving the record of British official rule, by one who has had ample opportunities of personal observation. Mdlle. de Bovet contributes a series of conversations with the composer Gounod, embodying his views on art and artists, which have been transcribed by one of his companions, and include much interesting matter never before published. A paper on the "Fortress of Paris," illustrated with a map, explains the great political and strategical importance of the city, which it is claimed is unsurpassed in these respects by any capital in Europe. J. D. Bourchier describes the "Great Servian Festival," the anniversary of the fall of Servia's greatness on the battlefield of Kassovo, in 1389. Walter Pater writes on Giordano Bruno, whose works have received new attention from scholars since the unveiling of his monument in Rome. W. D. Hogarth contributes an article on the "Present Discontent in Cyprus," condensing the history of the island since 1878, when it was taken under the protection of England. W. L. Courtney tells the story of the life of Roger Bacon, with special reference to his life at Oxford, and presents an interesting study of a much neglected figure in English history. Oswald Crauford draws a picture of Spanish and Portuguese bull-fighting; and Professor Tyrell contributes a brief note on Mr. Browning's late attack on Edward FitzGerald. The number concludes with "Some Truths about Russia," by a former resident.

— Messrs. E. & F. N. Spon announce as nearly ready "Practical Electric Bell Fitting: a Treatise on the Fitting-up and Maintenance of Electric Bells and All the Necessary Apparatus," by F. C. Allsop; "A Dictionary of Electric Words, Terms, and Phrases," by E. J. Houston; "Practical Gold Mining, a Comprehensive Treatise on the Origin and Occurrence of Gold-Bearing Gravels, Rocks, and Ores, and the Methods by which the Gold is extracted," by C. G. Warnford Lock; "Egyptian Irrigation," by W. Willcocks, M.I.C.E., with introduction by Lieut.-Col. J. C. Ross, R.E., C.M.G.; and "The Engineer's Sketch-Book of Mechanical Movements, Devices, Appliances, and Contrivances," by Thomas Walter Barber, containing details employed in the design and construction of machinery for every purpose, collected from numerous sources and from actual work, classified and arranged for reference for the use of engineers, mechanical draughtsmen, managers, mechanics, inventors, patent agents, and all engaged in the mechanical arts, with nearly two thousand illustrations, descriptive notes, and memoranda.

— The *Contemporary Review* for August opens with an article on the papacy, which has attracted much attention abroad. The writer says that to re-establish the temporal power, the church must be Anglicized or Americanized. This is illustrated by the startling statement that the papal rescript against the plan of campaign was launched by the pope under the pressure of the English government, against the advice of Persico, who has hitherto been held responsible for that blunder. Sir Morell Mackenzie contributes a valuable paper on the voice, treating of song. The address by Frederick Harrison before the Positivist Society on the centenary of the Bastile is reproduced entire, and presents a graphic picture of some of the more exciting episodes of the French revolution. Sir W. W. Hunter presents a plea for a female medical profession for India, which is, he says, the only hope of reaching Indian women. Canon Cheyne argues for reform in the teaching of the Old Testament, and looks for an idealized church in the future. Incidentally he touches on the agnostic controversy, and the more important of recent theological writings. Frederic Mackarness reviews some of the recent experiments in governing South Africa by the English authorities; and George J. Romanes writes a scholarly and interesting paper on "Mr. Wallace and Darwinism." Mr. Romanes is a Darwinian, and does not follow Mr. Wallace in some of his recent theories. Managers of picture exhibitions will find much of interest in the paper by M. H. Spielmann on the "Proposed Royal Academy Reform," in which the writer tells what the proposed reforms are, and what they should be. Philip H. Wickstead presents a study of Ibsen's "Peer Gynt," and affords an instructive insight into the methods of a master who is the literary sensation of the day in England, and who is looked upon by many critics as the greatest dramatist of the age. The number closes with an article on the "Civil List and the Grants to the Royal Family," by Dr. Henry Dunckley, who goes into the subject historically, and gathers many curious and little known facts in a subject which is just now agitating England, and which has attracted no little attention in this country.

— Professor Henry C. McCook of the Academy of Natural Sciences, Philadelphia, is now prepared to issue his natural history of the habits and industry of our orb-weaving spider fauna, under the general title "American Spiders and their Spinning Work." It embraces studies extended over more than fifteen years, and will be printed in three volumes, quarto. Volumes I. and II. will contain the author's personal observations, studies, and illustrations of the habits and industry of spiders. The studies are particularly directed to the spinning habits of the great group of spiders known as orb-weavers; but these are expressed in their relations to all the other tribes in both hemispheres. Volume III. will contain the systematic part of the work, and embrace descriptions of the orb-weavers of the United States, illustrated by a number of fine lithographic plates painted by hand in the colors of nature. The volumes will be profusely illustrated, wholly from nature, the number of engravings in the first volume alone exceeding two hundred. The language is as free as possible from technical terms, and, as the matter principally concerns the life-history of the animals, the chief contents of the work can be readily followed by any intelligent and sympathetic reader. This is especially true of Volume II. The publication of such a considerable work has involved a large expense, and as the circulation is necessarily limited to important scientific societies, leading public libraries, and a small circle of private individuals, the author has been compelled to undertake the entire work and charges of publication. The number of prints will be absolutely limited to five hundred, but an edition of two hundred and fifty copies, which will be known as the "Author's Edition," will now be issued; and the price of the volumes has been fixed, as nearly as could be estimated, at the simple cost of publication. The price for the entire set of three volumes will be $30 for colored plates, or $25 for uncolored plates. No volume will be sold separately. All persons subscribing within three months from Aug. 1, 1889, will receive the entire set with colored plates for $25, delivered, postage paid, in any part of America. The price post-paid for Europe and all foreign countries is £5 4s., English money. After the limited time, no books will be sold for less than the full price, with postage added. Payment will be expected as follows: $10 on the delivery of Volume I., $10 on delivery of Volume II., and $5 on delivery of Volume III. Full payment may be made, if preferred by subscribers, on delivery of Volume I. The first volume will be delivered in the autumn of this year; the second volume, shortly thereafter; and the third volume, which is already in a good state of progress, in the early part of 1890. The several volumes will be mailed with uncut edges in suitable form for library binding. Societies, libraries, and individuals who may purpose to subscribe will materially forward the author's plans by acting promptly.

— The *Nineteenth Century* for August contains papers by an imposing list of writers. Frederic Harrison opens the number with "A Breakfast in Paris," giving the views of a number of representative Parisians on the Exhibition and the political state of France. L. Atherly Jones writes on "The New Liberalism," which, with home rule, he believes to be destined to succeed, though possibly not for some time to come. Dr. Burney Yeo presents some valuable suggestions on "Change of Air," which he regards as almost imperative for city people. He also gives an analysis of the ocean cure, with suggestions as to places of resort for invalids. Sir Joseph Fayrer begins a description of the deadly wild beasts of British India. a subject of great importance when it is remembered that 2,618 persons and 61,021 head of cattle perished in 1887 by animals alone, not counting snakes, which caused

the death of 19,740 persons in addition. The Rev. Father Barry argues for a "Gospel for the Century," claiming that the church, like the age, must be progressive. Walter Frewen Lord describes the life and writes of Henrik Ibsen, the Norwegian dramatist whose works are exciting so much attention in England. Lord Brabourne replies to Mr. Gladstone's article on the Irish union in the July number, in a paper in which he takes the great statesman to task for not accounting for the actual condition under which the cruelties he censured so severely were practised. Lord Ribblesdale has a light though interesting study on the "Art of Conversation," relating his own experience in acquiring that difficult accomplishment. Mr. Gladstone neglects politics this month, and returns to his classical studies in a paper on the "Phoenician Affinities of Ithaca," a much argued question among Greek scholars, which he endeavors to answer. Professor Geffcken contributes a paper on "The French in Germany," reviewing the history of French treatment of Germany and Germans in the last few centuries. Germany, he claims, has suffered more in that time from France than she did from the war of 1871, and he therefore argues that the treaty of Frankfort should be regarded as final. Frederick Greenwood presents an interesting essay on love and men and women, entitled "Wool Gatherings;" and John Morley, W. S. Lilly, R. E. Prothero, Sir Frederick Bramwell, H. G. Hewlitt, Frederic Myers, and the Hon. Hallam Tennyson review some noticeable books. The number closes with a rejoinder on female suffrage, by Mrs. Creighton, and a long list of signatures to the protest against suffrage printed in the June number.

— The Clark Electric Company, 192 Broadway, New York, have issued a new catalogue of their arc light apparatus. In this is given, with illustrations, some account of their arc dynamo, with a view showing the interior field and others of the armature, automatic regulator, etc. The single and double arc-lamps are described. The pamphlet closes with a description of their new automatic regulator.

— The current number of the *American Journal of Psychology* is strong in four original papers. The first, by Dr. William Noyes, contains a further account of an interesting paranoiac described by him in an earlier number of the journal (May, 1888). The patient, an artist of talent and originality, has continued his painting, and latterly busied himself with the composition and illustration of a manuscript book of two hundred pages. The six plates accompanying this article reproduce nearly fifty pictures, of which three are taken for comparison from his pre-asylum work, and two-thirds of the rest are pen-and-ink drawings from the book. Considerable extracts, both of prose and verse, are given, the latter especially showing the same mixture of facility and imperfect finish that characterizes his pictures. It is rare that an alienist has the opportunity of observing a case where the disordered mind has such varied and delicate means of expressing itself. The next article is an experimental study, by Dr. C. F. Hodge, of the effect of electrical stimulation upon ganglion cells. The outcome of these careful experiments is a method "by which changes due to functional activity can be as easily and certainly demonstrated in a ganglion as in a gland." Electrical stimulation noticeably decreases the size of the nucleus, makes it jagged in outline, obscures its reticulation, and makes its stain darker. In the cell protoplasm it causes vacuolation and slight shrinkage, and makes its stain less readily. The nuclei of the cell capsule are also shrunken. These changes are figured in an accompanying plate. In the third article, Dr. E. C. Sanford concludes his series on personal equation, taking up especially the amount and cause of personal differences under the simplest conditions of observation. He brings together the contributions of the astronomers and physiological psychologists, and considers the theories of Bessel, Wolf, and others. A bibliography of a hundred titles or more is appended. Dr. W. H. Burnham furnishes a very interesting paper on the illusions and hallucinations of memory, or, as the phenomena have been termed, paramnesia. An example of a single class is the not uncommon feeling of strange familiarity in totally unfamiliar circumstances. Other kinds are rarer, but by no means unknown. Important contributions have come from the alienists, notably from Kraepelin, whose classification Dr. Burnham follows. The author has been fortunate in collecting a number of illustrative cases (such tricks of memory seem frequent in dreams, with some people at least), which parallel in normal life the grosser cases of the insane. The subject has also a practical bearing; for Hughlings-Jackson, while admitting that the feeling of reminiscence above mentioned does occur in normal people, would regard its frequent occurrence as a confirmatory symptom of a certain form of epilepsy. In persons of somewhat defective memory and judgment, as children and old people, a skilful lawyer can, by proper manipulation, create, entirely without the consciousness of the witness, a memory of events that never happened; and, like Professor Royce, the author would account for many cases of presentiments, telepathy, etc., reported by trustworthy people, as cases of pseudo-memory. The number contains, as usual, reviews and abstracts of literature on the nervous system and experimental and abnormal psychology, besides miscellaneous notes. In the abnormal section is included also a paper of practical suggestions to physicians in asylums, hospitals, etc., for the observation of patients suffering from mental and nervous diseases, by Dr. H. H. Donaldson. The suggestions are accompanied throughout by references to the literature.

## LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

### Sunset Glows.

WE have just been enjoying a re-appearance of sunset glows like those following the Krakatoa eruption of 1883, though much less bright. The phenomenon was first noticed here after sundown of July 13. On the 14th and 15th it seemed to increase in intensity. After this it declined, and I think could not be clearly distinguished after the 20th.

I noted a whitish glow around the sun, occupying a space of about fifteen degrees' radius, as in "Bishop's ring." The outer colored ring characteristic of that corona seemed to be entirely lacking.

I have remarked the following peculiarities in which these differ from the Krakatoa glows: they are very much less bright, perhaps like those after a lapse of several months.

A notable difference is in a beautiful tertiary glow. This consisted of a rich and delicate rosy flush occupying a tract of sky in the west, say of sixty degrees horizontally, and from five down to ten degrees of altitude. At the edges this melted into purple upon the clear blue of our North Pacific sky. A faint purple tint extended along the horizon quite to the south: no color in the north. There are islands a little north of west, intercepting reflections. This third glow failed to gather down and deepen upon the horizon like those preceding it. I think its tint the most beautiful I have ever seen in the heavens, like that of some rare and perfect jewel.

A very marked peculiarity is the early time at which the primary and secondary glows take place. The primary glow gathers soon after the sun is down, and is at its height while daylight is yet strong. Hence it is less conspicuous, although its broad streaming radiations of glowing surface are very remarkable.

The secondary glow promptly follows, and makes the grand display. It is nearly finished before any stars are visible. The Krakatoa secondary began in a somewha t darkened sky, — as dark as when the late tertiary appeared, — and lingered until after full darkness, slowly settling down into a low, dense, blood-red stratum, which simulated the reflection of a remote conflagration.

That strange dull-red glow was entirely absent from the late appearances. The secondary gathered and settled away in a bright orange glow. Both at its close and throughout its course, this secondary substantially resembled the Krakatau primary as seen several months after the eruption. Like that, it presented at its close a well-defined and serrated upper edge, bordered by dark sky. The serrations of the latter, however, were small and numer-

ous, apparently the inverted shadows of cumuli upon a very remote horizon. In this, on the contrary, the serrations are large, as if caused by the intervention of cloud-masses upon a near horizon.

It seems evident that the reflecting stratum of haze in these late glows was very low down as compared with the Krakatoa haze. The shadow of the horizon was projected upon a haze-canopy quite close at hand. Hence also the early production of the primary glow, and the rapid following of the secondary. For the same reason, the extent of lower atmosphere traversed by the sun's rays during the repeated reflections was greatly reduced; less of red was consequently shown, the other colors being only partially intercepted. Again, the twice reflected rays still retained force for a slight but definite third reflection, in which a pure though faint red appears.

We have as yet no cable, though in strong hope of one soon. No foreign mail has reached us since the 6th instant. One is due to-morrow, and we hope to hear of some adequate cause to which this remarkable phenomenon may be owing.

SERENO E. BISHOP.

Honolulu, July 25.

### "Suggestion."

A FEW evenings ago I went to a friend's house to hear the phonograph. It was reproducing with fidelity the music of a band. To promote the illusion, I closed my eyes. Presently an air was played that sounded familiar, though I failed to recognize it. Neither did I strive to, for my attention was concentrated on the quality of the sound. As I listened, however, I became conscious of a set of surroundings: a pair of eucalyptus trees opposite, a large domed building to my left, a street of white flat-roofed houses on which I looked down, even a familiar sign-board caught my eye (the inscription ought to have been "Biblioteca Pública"), the strains of the military band in the plaza coming through the star-lit night. Involuntarily my eyes opened, and I caught my breath at sight of the lamps and assembled company of a drawing-room; for I had been listening, from the *azotea*, or roof, of my former residence in the little Mexican city, to a favorite *danza* air played by the regimental band in the neighboring plaza. The change was so very startling that it made my heart pump. I closed my eyes, and though I did not again lose consciousness of where I was, the Tepic picture materialized again as vividly, and with all the detail that could have been present to the eye of sense. I requested that the air (the *danza*) might be again put through the instrument, and while it played, I still held the picture, and had wandered off into a brown study, a thousand Mexican images and incidents rising of their own accord and passing before the imagination. While this was going on, and without my becoming conscious of any change in the source of suggestion, the picture became blurred, faded, and indistinct, and the train or procession of incidents broken and desultory. This led to my consciousness that a different air — a German one — that I had never heard from a Mexican band, was now proceeding from the apparatus. W.

San Francisco, Cal., Aug. 10.

### Minute Aeronauts.

DURING the year 1875, while engaged in some scientific investigations in Contra Costa County, Cal., my attention was attracted to the numerous webs floating in the air. Some were wound together so as to resemble small pledgets of cotton, others were long streamers. After having made several inquiries as to their cause but gaining no satisfaction, I sat about an investigation. I started up a high hill from which all these webs seemed to have their origin. During my ascent I noticed that my hat and clothing began to be covered with webs, and finally I discovered a small spider spinning a web from my hat brim to the ground. When it reached *terra firma* I sat down to watch it and to study its movements. It immediately searched out a slender stalk of a weed and made its way to the top. It remained there for a few moments perfectly still, as if it was taking observations. Then it began spinning web, and by a peculiar motion of its legs it would roll or gather the web in a mass, and when enough had been accumulated in this manner to carry the little creature, it would let the flaky mass flow out to the winds. When it had thus formed a little parachute, or balloon, it would swing itself out in the air and sail in obedience to the winds. Continuing my journey up the hill I noticed scores of these spiders rigging their aerial ships preparatory to visiting some distant place. When near the top of the hill I was surprised to see webs sailing hundreds of feet above the summit. I turned my field glass in a direction toward the sun, where I could best discern them, and as far as my aided eye could reach I could still see them. They probably came from a great distance, as they were five or six hundred feet above the crest of the hill. When these little aeronauts came near the ground in their travels, they would descend on a web and abandon their balloon. I watched these spiders for hours, and none of them ever made a mistake as to the quantity of the web that would carry them. They could in this way travel hundreds of miles in a day.

R. I. BROMLEY, M.D.

### Queries.

47. WHAT BIRDS ARE THESE? — (1) Head and back, black; breast and belly, rich reddish brown; length, seven inches; from tip to tip of extended wings, ten inches; sides of bill, slate; legs, black; Insessorial; bird seen in orchard. (2) Breast, yellow; back, yellowish olive-green; throat of male, black; male larger than female; bill, conical; length, medium or rather long; size of bird described above or smaller; song similar to bird described above. Nests in orchard, top of tree; nest composed of grass, not placed in fork of branches, but suspended, — in which it deposits three cream-colored eggs, black-blotched at the larger end; food, worms. (3) Breast of male, yellowish with black spot; back, dark brown and white; striped or mottled; bill rather large, short, conical. Of two nests seen, one was in a meadow, about eight inches from the ground, supported by the grass, and the other three feet high, in a roadside hedge: both contained four blue-green eggs. Size of wood-pewee; song, short; seen in fields; female rather smaller and duller colored, and lacking the black spot on breast. There is a yellowish stripe above the eye. L. W. N.

### Answers.

47. THE first and second birds described are orchard orioles (*Icterus spurius*), the brown and black one being an old male; the yellow olive one with black throat the male in its first year. The last bird is the black-throated bunting or dichcissel (*Spiza americana*.

## INDUSTRIAL NOTES.

### The Union Electric Car Company.

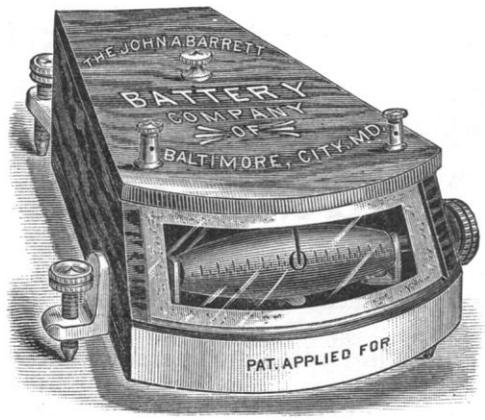
CARS operated on the system controlled by the Union Electric Car Company of Boston, Mass., will soon be running between the towns of Beverly and Danvers, Mass. One of this company's cars was run on the West End Railroad in Boston for eighteen months, never failing to do what was expected of it. This company uses dynamos and motors of the United States Electric Light Company's make, and intend to use either the storage, overhead, or conduit system, or a combination of all three, as may be found expedient. One of the peculiar features of the Union company's system, for which they hold a patent, is the charging back, while using a series motor, into the battery or line, while stopping the car or holding it back in going down grade, the motor being converted into a dynamo for the time, deriving its power from the momentum of the car.

Another feature of this system, also patented, is the use of a peculiarly formed cut gearing for transmitting motion from the motor to the wheel-axle. The gearing is inclosed in a dust-proof case, partly filled with oil, so that the gearing runs in an oil-bath, insuring thorough lubrication and decreasing the friction and wear of the gear-teeth. The company claims that this one feature saves a large percentage of power besides greatly increasing the life of the gearing.

### The Barrett Mil-Ammeter.

The mil-ammeter shown in the accompanying sketch has been designed especially to meet the wants of the medical practitioner, and, with this end in view, has been made as compact and uncomplicated as is consistent with accuracy.

The question of accuracy has to be carefully considered in instruments of this kind, for the present tendency in the application of electricity to medicine and surgery is to obtain results based upon such systems of measurement as shall be comparable at any locality.




THE BARTLETT MIL-AMMETER.

The John A. Barrett Battery Company's mil-ammeter is believed to be an important improvement over most instruments of its class, and it embodies in its construction several features which are entirely novel.

Of these, the most important is the manner of rendering the metre capable of measuring currents of very great differences in value. This is secured by a system of shunts which are automatically thrown into circuit simultaneously with a corresponding change of the scale. The instrument is provided with three independent scales, whose ranges are respectively 0-5, 0-25, and 0-250 milli-ampères. By turning a screw at the side of the case, these scales are made visible one after the other, and at the same time the corresponding shunt is put in action, so that correct readings may be taken at once.

The metre is also provided with a screw-clamp, which removes the pivoted needle (the needle having a jewel pivot) from its bearing; and when this is adjusted, the instrument can be carried around with little care and with almost perfect safety.

Recently the range of these metres has been extended, so that they now read up to 1,000 milli-ampères.

### Electrical Train Heating.

The Burton Electric Company, of Richmond, Va., have recently been making some experiments with their electric heaters for railway cars, a Sprague electric car being used for the purpose. An 80 volt current was used. Each heater had a resistence of 35 ohms, and required 2⅛ ampères of current to raise the temperature 200 degrees Fahrenheit. The heater is composed of a resistance coil, inclosed in a cast iron case provided with projections for increasing the radiating surface. The wires of the resistance coil are covered with powdered clay, to absorb the heat and prevent the wires from being burnt out. In the experiments mentioned fourteen heaters were used, absorbing three and a half electrical horse-power. The heaters were connected in multiple arc. In practice it is proposed to generate currents on trains under way by means of dynamos driven from the car-axles, the cars to be heated before starting out by currents from stationary dynamos at the stations.

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